

## **Attachment 1**

### **SPECIFICATIONS**

**DTFAEN-12-R-00101**

**Installation of Leak Detection System  
in the**

**Automation and Communications Equipment Rooms at the  
San Juan CERAP  
Carolina, Puerto Rico**





ZSU SAN JUAN CERAP  
San Juan, Puerto Rico  
Install Leak Detection in Automation and Communications  
Equipment Rooms.

FINAL DESIGN SPECIFICATIONS

September 2011  
**SPEC. # FAA-ZSU-1005706**

Prepared by: Federal Aviation Administration  
ATO Tech Ops Engineering Services  
Atlanta Enroute Unit

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SECTION 01000 GENERAL REQUIREMENTS

PART 1 – GENERAL

1.1 SCOPE

Scope - These specifications, together with referenced specifications, standards, construction drawings specified in the Contract Documents and the conditions of the Construction Contract cover the requirements of the Federal Aviation Administration (FAA) for the work associated with this project.

1.2 REPAIR AND PROTECTION

- A. General: Upon completion of inspection, testing, sample taking and similar services, repair damaged construction and restore substrates and finishes.
- B. Protect construction exposed by or for quality control service activities, and protect repaired construction.
- C. Contractor is responsible for, but not limited to, all repair and protection of existing equipment, systems and services, associated with or affected by the contract requirements and work area.

1.3 SEVERE WEATHER PREPAREDNESS PLAN

The contractor shall submit a Severe Weather Preparedness Plan that includes hurricanes and tropical storms. It should include items such as:

- A. 48 hrs prior to a severe windstorm such as a tropical storm or hurricane the contractor shall begin to secure the site and protect the facility as it relates to the construction area from the elements. The site shall be cleaned and all items that may become airborne shall be secured, tied down or stored properly.
- B. 24 hrs prior to a severe windstorm the contractor shall be prepared to evacuate the site for personnel safety.
- C. The contractor shall be prepared to commence work within 24 hrs following a severe windstorm.
- D. The Government would consider extending the contract based on the number of days the contractor is impacted by a severe windstorm. However, no additional compensation will be considered.

1.4 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
- B. Publication Dates: Comply with the standards in effect as of the date of the Contract Documents.
- C. Conflicting Requirements: Where compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different but apparently equal to the COR for a decision before proceeding.
  - 1. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with

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these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of the requirements. Refer uncertainties to the COR for a decision before proceeding.

- D. Copies of Standards: Each entity engaged in construction on the Project must be familiar with industry standards applicable to its construction activity. Copies of applicable industry standards are not bound with the Contract Documents.
  - 1. Where copies of standards are needed to perform a required construction activity, the Contractor shall obtain copies directly from the publication source and make them available on request.
- E. Abbreviations and Names: Trade association names and titles of general standards are frequently abbreviated. Where abbreviations and acronyms are used in the Specifications or other Contract Documents, they mean the recognized name of the trade association, standards-generating organization, authorities having jurisdiction, or other entity applicable to the context of the text provision. Refer to Gale Research's "Encyclopedia of Associations" or Columbia Books' "National Trade & Professional Associations of the U.S.," which are available in most libraries.

### 1.4 RECORD DRAWINGS

The Government shall provide the Contractor with an electronic copy of the record drawings in .PDF format. Changes to the original plans, drawings or shop drawings shall be annotated in red.

END OF SECTION 01000

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## SECTION 01010 SUMMARY OF WORK

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Scope of Work - These specifications, together with the referenced specifications, standards, and drawings specified in the contract documents cover the requirements for all work associated with the

1. Automation Equipment Room: Remove existing PVC insulation cover on chilled water piping serving air handling units CRU-4, CRU-5, AHU 4A, AHU-4B, and AHU-5 from under-floor plenum and above. Install new leak detection cable on this piping and cover with new PVC pipe insulation cover. Install leak detection cable around perimeter of both air handling units CRU-4 and CRU-5 on concrete plenum floor. Install new leak detection panel for these units in Room B101. Connect new leak detection cable to new leak detection panel.

2. Communications Equipment Room: Remove existing leak detection panel and leak detection cabling for air handling units CU-1, CU-2, and CU-3 on concrete plenum floor in Room B110. Install new leak detection cable on chilled water piping and domestic water piping in the raised floor plenum serving these three air handling units. Cover new leak detection cable on chilled water piping with PVC pipe insulation cover. Install new leak detection cable on concrete plenum floor around perimeter of each air handling unit CU-1, CU-2, and CU-3. Install new leak detection panel for these units in Room B110. Connect new leak detection cable to new leak detection panel.

3. Connect new leak detection panels to existing facility Direct Digital Control (DDC) System. Each leak detection panel shall send an alarm to the existing front end computer when a leak is sensed by the new leak detection systems. Provide all DDC front end programming and graphics, control and communications conduit and wiring, electrical power supplies, and any other required DDC accessories.

This work will take place at the San Juan CERAP, located in Carolina, Puerto Rico.

The General Contractor (GC) shall be expected to work during day times, 0700 AM to 0430 PM. Extensive coordination between the GC and FAA personnel shall be required at all times in order to maintain an operational facility. **Prospective bidders are strongly recommended to perform a site visit to assess the actual conditions before submitting a bid. Site visits should be arranged thru the Contracting Officer's Office.**

- B. FAA Holiday Moratorium - No work shall be scheduled or take place during the week of and the weekend preceding and following: The Thanksgiving, Christmas and the New Years Holidays. Only emergency work to restore critical services to the Facility will be considered and a moratorium waiver must be submitted and approved. The moratorium period will not be counted against the contract construction duration of the project.

- C. FAA Holidays Observed - The FAA also observed the following Holidays:

1. Birthday of Martin Luther King, Jr.
2. Washington's Birthday
3. Memorial Day



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4. Independence Day
5. Labor Day
6. Columbus Day
7. Veterans Day

If the Contractor thinks that work will be required on any of these Holidays he will need to coordinate with the Contracting Officer Technical Representative (COTR) two weeks in advanced. The Holidays observance will not be counted against the contract construction duration of the project.

- D. Intent of Specifications - This specification identifies all material, labor, and equipment required to perform this work. All work performed and all materials and equipment used are subject to approval by the Contracting Officer (CO) and /or the Resident Engineer (RE). This shall include but is not limited to inspection, scheduling, reporting and submittals.
- E. Title - Titles to division and sections of the specifications and notes and titles on drawings referring to subcontractors, division of work by trade, or type of work, are introduced merely for convenience in reading the specifications and drawings and do not imply any separate contractual arrangements of work assignments. Such separations into titled divisions and sections shall not operate to make the Government an arbiter to establish subcontract limits between the contractor and subcontractors, or between the subcontractors themselves.
- F. Contract Documents - The drawings, as shown on the "List of Drawings" in Attachment 2 in each specification package, General, Architectural, Mechanical, Electrical, and Southern Standards, all form a part of the construction requirements for this project. The renovation of these systems shall be in accordance with the lines and grades shown on the drawings. The Contractor shall not use dimensions scaled from drawings. All dimensions shown on the drawings shall be field verified by the contractor prior to any modifications and fabrications. Any discrepancies between the drawings and specifications and the existing conditions shall be referred to the CO for adjustment before any work affected is performed.
- G. Precedence of Contract Documents - In the event of a difference between the following contract provisions, the order of precedence to determine which provision shall govern is:
1. Contract Clauses and Provisions
  2. Project Specifications
  3. Project Drawings
- Any discrepancies between the contract provisions, the specifications and the contract drawings shall be referred to the CO for a written determination in accordance with Contract Clause entitled Order of Precedence.
- H. Contracting Officer -The term "Contracting Officer" (CO) as used herein denotes the person designated to act on behalf of the Government in the performance of this contract. Where reference is made to "Federal Aviation Administration" (FAA), "Resident Engineer" (RE), "Contracting Officer's Representative" (COR), or the like, this shall mean the Contracting Officer or his/her authorized representative.
- I. Contractor Superintendence - In accordance with Contract Clause entitled SUPERINTENDENCE BY THE CONTRACTOR, the Contractor shall at all times during performance of this contract and until

the work is completed and accepted, directly superintend the work or assign and have on site a competent superintendent with the authority to act for the Contractor.

The Contractor shall submit a Project Organizational Chart with the key personnel identified and their qualifications for the Government's review and approval.

## 1.2 SPECIAL REQUIREMENTS

- A. Asbestos Containing Materials. - **No new materials supplied by the contractor for this construction shall contain asbestos or lead-based products.** The contractor shall verify that all materials, including those supplied by third parties, are asbestos free and/or lead-based free materials.
  1. Contractor certification requirements. - The contractor shall provide to the Contracting Officer (CO) a signed and notarized document stating that to the best of his/her knowledge, no asbestos containing or lead-based materials were used during the construction, renovation, and/or modernization of this facility.
  2. Material Safety Data Sheets. - The contractor shall submit Material Safety Data Sheets (MSDS) with all submittals for review and approval by the Contracting Officer. New materials found to contain asbestos and/or lead-based products will be automatically disapproved. Copies of all MSDS sheets shall be provided to the facility FAA personnel for the building records. The contractor shall comply with all health and safety provisions outlined in each MSDS and shall follow all OSHA guidelines regarding personnel protection.
  3. Hazardous materials. - If the FAA RE suspects the presence of asbestos or lead-based products in the new materials, the FAA will sample the suspect material to verify that no asbestos containing material or lead-based material were used. If these materials are found to contain asbestos or lead-based products, the cost of the survey and all subsequent removal/replacement of any hazardous materials shall be at the contractors' expense.
- B. Work plan and scheduling. - Prior to the Contracting Officer issuing the Notice To Proceed (NTP), the contractor shall submit for approval a plan and schedule of his work. This schedule shall include all of the requirements as defined in Section 01042 of this specification and Section 01300 , para 3.2 of this specification.
- C. Sequence of work. - The contractor shall be responsible for scheduling all aspects of the work and coordinating among the different trades involved in the project. The contractor shall follow the guidelines outlined in the sequence of work as described in the contract drawings. The Federal Aviation Administration has developed a list of milestones that the contractor shall be required to meet.
- D. Construction Activities and Milestones. - Construction Activities and Milestones below shall be included in the submitted schedule. They are provided for guidance, but are not intended to direct how and when contract activities shall be ordered or take place in the submitted schedule.
  1. SUBMITTAL APPROVAL
    - a. Construction Schedule
    - b. Leak Detection Equipment

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2. ORDER LONG LEAD ITEMS
  - a. Leak detection panels and cabling.
3. NOTICE TO PROCEED
  - a. Scheduled by the FAA's CO
4. ESTABLISH PROTECTION OF PERSONNEL AND EQUIPMENT
5. COMPLETE DEMOLITION
  - a. Remove existing leak detection systems and pipe insulation covering
6. NEW WORK
  - a. Install new leak detection systems and new leak detection panel power supplies.
  - b. Test new leak detection systems in presence of COTR
  - c. Install new insulation cover over piping that has received new leak detection cable
  - d. Install new DDC control conduit and wiring from new leak detection panels to existing facility DDC front end computer. Program and test new DDC leak detection panel points. .
  - a.
10. REMOVE PERSONNEL AND EQUIPMENT PROTECTION
  - a. Remove equipment Lockout devices
11. Facility Tech Training Class
  - a. Coordinate Leak detection system and DDC training and class schedule with Contracting Officer Technical Representative (COTR)
12. Equipment Warranty
  - c. Leak Detection Equipment
13. CLOSE JOB

E. Driveway Closures - Contractor shall maintain access to the loading dock at all times.

END OF SECTION 01010

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SECTION 01030 SITE ACCESS, CONSTRUCTION LIMITS, USE OF FACILITIES AND WORK HOURS

PART 1 – GENERAL

1.1 SUMMARY

- A. Existing facility operations. - Construction/demolition shall in no way interfere with Air Traffic Control Operations. The CERAP is a 24 hour, seven day a week facility. Extreme care shall be exercised so as not to cause any interference or interruption of service from this facility. Controller functions are vital to the safety of the flying public. It is absolutely mandatory that the contractor protects FAA personnel and existing FAA communication, electrical and mechanical equipment both inside and outside buildings from damage caused by impact, water, debris, dust or odor. The contractor shall have the overall responsibility for the performance and enforcement of all forms of protection within the CERAP premises against any damages due to work performed under this contract. Any damages incurred, as a result of construction activity during the performance of this contract will be repaired/replaced immediately by the contractor at no cost to the FAA.

Any work or activity that may impact the National Airspace System (NAS), such as work on critical equipment or circuits, will require coordination with the Contractor Office Representative (COR). The COR will prepare and submit a work or activity specific "Risk Assessment" for the facility's review and approval. This process may take one week to complete. Typically, this type of work or activity is performed from midnight to 05:00 am and/or on weekends.

- B. Construction limits and access. -

1. Construction limits.- The contractor shall confine operations, activities, storage of materials and employee parking within the designated areas, as indicated on the construction staging plan, or as designated by the COR. Additional space the contractor deems necessary shall be obtained off site, at no additional cost to the Government.
2. Access. - Access route for the contractor, subcontractors, employees, deliveries, etc., shall be designated by the COR. Access to all, parking areas, and loading dock shall be kept unobstructed. If temporary access obstruction is unavoidable, the contractor shall advise the COR immediately. Vehicles transporting materials shall not be loaded beyond the capacity prescribed by federal, state, or local laws. Obstruction of existing roadways, driveways, to the CERAP is strictly prohibited.
3. Damage to site. - Damage to existing paving, lawns, curbs, sidewalks, and utilities caused by the contractor's activities shall be repaired immediately. Any damage to the building, interior or exterior, that are a result of the contractor's activities shall be repaired. All costs of repairs shall be paid by the contractor. After notice to proceed and prior to the commencement of construction, the contractor and COR shall conduct joint inspections of the existing areas affected by the construction. Existing damage or defects shall be noted and will be used as the basis for determination of damages caused by the contractor's operations.
4. The Contractors' employees shall not use the Cafeteria.

- C. Inspection of site by contractor. - It is strongly urged that the contractor carefully examine the premises to determine the extent of work and the conditions under which it must be done.

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- D. Government use and access to premises. - The Government reserves the right to enter the construction area at any time for work inspection and for the operation of the facility.
- E. Work hours. - All work hours, shifts, and overtime work shall be coordinated with the COR. Before commencing construction, furnish to the COR a statement of hours per day and days per week to normally be worked and approximate number of persons on the job for a normal work shift.
- F. Security requirements.
1. Personnel List. - Contractor shall provide the COR with a list of contractor personnel who require access to the CERAP. The list shall be submitted immediately after contract award. The list shall be kept current during the project and shall include the following:
    - Full name, including middle initial
    - Federal or State issued photo ID
    - Date of Birth
    - Place of Birth
  2. Security Investigation and identification. - Contractor's personnel may be subject to security investigation by FAA. The contractor shall promptly complete all security forms provided by the CO. Contractor's personnel shall report to the FAA security guard at entrance to the facility and submit proper identification when signing in to obtain an FAA badge which will be worn on an outside garment, above the waist and below the neck, facing forwards, at all times while on the CERAP premises. This badge shall be returned daily to the security guard when leaving the premises, unless otherwise noted.
  3. Vehicle identification. - Vehicle identification tags will be issued for contractor's and contractor's employees' vehicles that require access into the CERAP site. The identification tags shall be displayed in the windshield of the vehicle at all times when the vehicle is on the site. The contractor shall be responsible for the collection and return of all vehicle tags which are no longer required.
  4. Escort requirement. - Contractor is responsible to provide an escort for his employees. This will require a security background investigation by the FAA. Contractor's personnel shall not violate any security regulations pertaining to the CERAP facility. Violators may be removed from the premises with the right to reenter revocable. Contractor's day-to-day work schedules in the classified areas shall be so arranged to allow for minimum escort.
  5. Right to search. - Current procedures at FAA facilities include the "right to search." If in the judgment of the FAA a cause to search a vehicle or the person of personnel exists, such search will be made.
  6. Replacement of lost identification. - The FAA will provide personnel badges and vehicle identification tags as described above. It is the contractor's responsibility to return these badges and tags daily and upon completion of the project. The contractor shall be liable to pay for any FAA badge or tag not returned or replaced at the completion of the work. The payment for lost I.D. will be \$10.00 for each and every tag or badge not returned or replaced, excluding temporary badges.
  7. Physical Security. - At the end of each work day, the contractor shall secure all construction areas by closing and locking all doors and gates. The contractor is responsible for the

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security of the staging area, and shall provide the required measures at no additional expense to the government.

END OF SECTION 01030

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SECTION 01040 COORDINATION LOCAL PERMITS AND TESTING

PART 1 – GENERAL

1.1 SUMMARY

- A. Project coordination. - It shall be the duty of the Contractor to prepare a detailed schedule of work and work layout to resolve conflicts and to assure coordination of the work by different trades.
- B. Weekly Meeting. - Coordination between the COR and Contractor shall take place weekly at the site. Special meetings will be scheduled if requested by either the COR or Contractor. The subjects to be discussed at the progress meetings shall included, but are not limited to, the following:

- Safety concerns/Issues
- Progress of Work
- Previous meeting action items/issues
- Field problems
- Material and Equipment delivery status
- Submittal status/schedules
- Progress planned during the upcoming week(s)
- Review of changes, and potential effects on the schedule
- Construction schedule revisions
- Schedule Revisions
- Other current business

The following persons will be expected to attend meetings; FAA COR, Prime Contractor Superintendent, Project Manager and Project Manager/Superintendents for other major trades.

- C. Facility Coordination Meeting. - Weekly coordination meeting shall take place between the facility managers, COR and the Contractor's Project Superintendent.
- D. Work Affecting Operational Systems. - The contractor shall coordinate all work which has any or may have any impact on any operational system within the facility through the COR. The contractor shall immediately cease any work which is adversely impacting the operation of the CERAP and shall immediately repair or restore any portion of the operational system that has been damaged or suffered diminished performance as a result of the contractor's activities.
- E. Local permits and Coordination. - The Contractor will be responsible for obtaining and payment of all building fees, inspection fees, utility connection charges and any other fees or charges which may be incurred in the performance of this contract.
- F. Applicable documents. - The contractor shall comply with all local city, county, and state construction codes.

1.2 TESTING

- A. Contractor's responsibility. - Unless otherwise indicated as the responsibility of another identified entity, Contractor shall provide certified testing and inspection agencies, inspections, tests, and other quality-control services specified elsewhere in the Contract Documents and required by authorities having jurisdiction.

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1. Where individual Sections specifically indicate that certain inspections, tests, and other quality-control services are the Contractor's responsibility, the Contractor shall employ and pay a qualified independent testing agency to perform quality-control services.
  2. Where individual Sections specifically indicate that certain inspections, tests, and other quality-control services are the Government's responsibility, the Government will employ and pay a qualified independent testing agency to perform those services.
    - a. Where the Government has engaged a testing agency for testing and inspecting part of the Work, and the Contractor is also required to engage an entity for the same or related element, the Contractor shall not employ the entity engaged by the Government, unless agreed to in writing by the Government.
- B. Retesting - The Contractor is responsible for retesting where results of inspections, tests, or other quality-control services prove unsatisfactory and indicate noncompliance with Contract Document requirements, regardless of whether the original test was Contractor's responsibility.
1. The cost of retesting construction, revised or replaced by the Contractor, is the Contractor's responsibility where required tests performed on original construction indicated noncompliance with Contract Document requirements.
- C. Selection and payment. - The contractor shall pay for all testing. The contractor shall select and use a certified and qualified testing laboratory to perform the requirements of this contract. The testing laboratory shall be certified by the American Association of Laboratory Accreditation.
- D. Rejected materials or workmanship. - All materials or workmanship or both which have been rejected by the COR by reasons of failure to conform to the requirements of the Contract Documents shall be removed and replaced with new, acceptable materials by the contractor at the contractor's own expense. Contractor shall also pay for testing of new materials which have been installed in place of rejected materials.
1. The testing laboratory will furnish three copies of each report directly to the COR covering all of its determinations and conclusions. Reports will show all data customarily listed by the laboratory in reporting on quantities, qualities, and types of materials, together with their correlation with the project and applicable Specification Section.

END OF SECTION 01040

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SECTION 01042 CONSTRUCTION SCHEDULES

PART 1 – GENERAL

1.1 SUMMARY

- A. Description. - The work plan and schedule prepared by the contractor shall consist of a Gantt and Pert chart(s) and logical narrative plan. The charts shall show all significant activities and shall include detailed activities when critical work is to be performed. The schedule shall include the sequence shown in Section 01010-1.2.D.

1.2 PRODUCTS

- A. Diagrams -
1. Show the order of the activities.
  2. Include construction activities, the submittal and approval of materials, samples and shop drawings, the procurement of critical materials and equipment, fabrication of special materials and equipment along with their installation and testing, and costs associated with each activity in the bar chart.
- B. Progress Schedules. - Within 30 calendar days of contract award, the contractor shall submit the schedule and work plan. **A Notice to Proceed will not be issued until the schedule is approved.**

1.3 EXECUTION

- A. Review and Evaluation. - The Contractor shall participate in a review and evaluation of the proposed schedule with the Contracting Officer. Any revisions necessary as a result of the review shall be re-submitted for approval of the Contracting Officer within 14 days after the conference. The approved schedule shall then be used by the contractor for planning, organizing, and directing work, reporting progress, and requesting payment for work accomplished. If the contractor, thereafter, desires to make changes in the schedule, the Contracting Officer shall be notified in writing, stating the reasons for the change. If the Contracting Officer considers the change to be of a major nature, the contractor may be required to revise the schedule and submit it for approval, without additional cost to the government.
- B. Monthly Update. - The contractor shall meet with the COR at monthly intervals to discuss the construction progress. If the project is behind schedule and requires a change in the schedule, the contractor shall submit a revised schedule with a description of the delaying factors and their impact, and an explanation of corrective actions taken or proposed.
- C. Payment. - The monthly update shall show the activities or portions of activities completed during the reporting period, and their total value will be the basis for the contractor's periodic request for payment. Payment will be based on the total value of such activities completed or partially completed after verification by the Contracting Officer.
- D. Submission Requirements. - Schedule charts shall be on (minimum) 11" x 17" size paper. Update charts shall show the date of the latest revision. Schedule charts with revisions and monthly updates shall be submitted in three copies.

E. Requirements for Schedule Chart. -

1. Activities.- The significant activities to be included in the schedule chart shall include, but not be limited to:
  - a) The milestones listed in Section 01010-1.2. D.
  - b) Any system shutdowns or cut-overs
  - c) Any other significant activities the contractor or FAA feels necessary.
2. Format - Contractor should use Microsoft Project, cost loaded. A minimum of 30 activities should be included.

F. Shutdown and Cut Over.

1. Mechanical Systems. - All shutdowns when permitted and cut overs of computer air handling units shall be coordinated with COR. Only one air handling unit shall be off and unavailable at any given time. Equipment shutdown and lock-out shall be accomplished by FAA personnel.
2. Electrical Systems. - New construction shall have no impact on the critical or essential electrical service at this facility. However, all electrical connections within live power panels will be scheduled with the COR at least 14 days in advance. All electrical connections to existing panels shall be coordinated with FAA personnel. Equipment shutdown and lock-out shall be accomplished by FAA personnel.
3. Startup - Initial startup testing and training will be completed by the contractor.

G. Acceptance and Warranties

1. The Contractor shall warranty material and equipment furnished by the various manufacturers in writing for period of two (2) years (or not less than the industry standard for the material specified, nor the manufacturer's standard warranty period, whichever is greater) on building systems finishes or equipment from the date of final project acceptance by the FAA. Mechanical equipment in particular (HVAC equipment,) shall be warranted in writing for period of three (3) years (or not less than the manufacturer's standard warranty period whichever is greater), from date of final project acceptance by the FAA. The cost of any extended warranties will be included in the contract sum.

H. New utility work. - Interface all existing utility work with new work as indicated in the plans and specifications.

END OF SECTION 01042

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## SECTION 01300 SUBMITTALS

### PART 1 – GENERAL

Applicable provisions of this Section and other provisions and requirements of the Contract Documents apply to all sections, except as modified in Sections of Divisions 2 through 16.

#### 1.1 SUMMARY

Submit Shop Drawings, product data, samples, warranties, certificates, test reports and third party disposal letters as required by the contract documents.

#### 1.2 RELATED REQUIREMENTS

- A. Section 01040: Coordination and Testing
- B. Section 01651: Materials and Equipment
- C. Section 01800: Closeout Procedures

#### 1.3 SUBMITTALS

Submittals required include, but are not necessarily limited to, the following:

- A. Submittal schedule
- B. Construction progress schedule
- C. Submittal log
- D. Manufacturer's Data
- E. Operations and Maintenance Manuals

#### 1.4 SUBMISSION REQUIREMENTS

- A. Number of Copies - Submit in ample time for approval before installation. Unless otherwise noted, submit five (5) copies of documents to the Resident Engineer (RE). Three (3) copies will be retained by the RE. If additional copies are required, provide the quantity and submit additional copies to meet this requirement.
- B. Time for Approval - Receive submittal approvals prior to starting the work. Time necessary for government approval or disapproval of samples, certificates, test reports, and shop drawings will not be more than thirty (30) calendar days after receipt of a submittal. All materials installed in the work shall match the approved submittals. After a submittal has been approved, no substitutions will be permitted without written approval by the RE. No extension of Contract Time will be authorized because of failure to transmit to the RE sufficiently in advance of the Work to permit processing.

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- C. Submittal Approval - The checking, marking or approval of the submittal by the FAA shall not be construed as a complete check, but will indicate only that the product or method of construction and detailing is satisfactory. Approval will not relieve the contractor of the responsibility for compliance with the specifications or for any error which may exist. The Contractor shall be responsible for the dimensions and design of adequate connections, details, and satisfactory construction of all work. Possible approval actions taken by the FAA include:
1. Approved as submitted - If "approved as submitted" is marked by the RE, each copy of the submittal will be identified as having received such approval by being stamped and dated. After submittal has been approved, no substitutions will be permitted without written approval by the RE.
  2. Approved as noted - If "approved as noted" is marked by the RE, the submittal is satisfactory contingent upon Contractor acceptance of corrections, notations, or both, and if accepted, does not require resubmittal.
  3. Not approved - If "not approved" is marked by the RE, the submittal data does not meet job requirements and the Contractor must resubmit the corrected material in the same quantity as specified for the original submittal, within 14 days, for approval by the RE. Approval of resubmittals by RE requires an additional fourteen (14) calendar days.
  4. Submittal Schedule - Identify within the Contractor's Construction Schedule a schedule of submittals for shop drawings, material approval, etc., showing the dates when submittals will be submitted for the project.
    - a) Contents - On the schedule indicate the following information:
      - 1) Schedule date for submittal
      - 2) Related Section number.
      - 3) Submittal category (Shop Drawings, Product Data, or Samples).
      - 4) Name of the subcontractor (if applicable)
      - 5) Description of the part of the Work covered.
  5. Distribution - Following response to the initial submittal, print and distribute copies to the RE, Government, subcontractors, and other parties required to comply with submittal dates indicated. When revisions are made, distribute to the same parties. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in construction activities.
  6. Schedule Updates - Revise the schedule after each meeting or activity where revisions have been recognized or made.
- D. Construction Progress Schedule – The progress chart to be prepared by the Contractor pursuant to the Contract Clause entitled "SCHEDULES FOR CONSTRUCTION CONTRACTS" shall consist of network analysis system, or pertchart (barchart). The



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contractor shall be required to complete the work within the contract time limits after receipt of Notice to Proceed excluding the FAA holiday moratorium as specified in section 01010.

1. Contractor should use Microsoft Project, cost loaded. A minimum of 30 activities should be included.
2. The diagram shall show a continuous activity flow from left to right. The diagram shall show the sequence in which the work is to be accomplished as planned by the Contractor.
3. Dates shall be shown on the diagram for start of the project, any milestones required by the contract, and contract completion.
4. The critical path shall be clearly identified.
5. Network activities shown shall include submittal and review of shop drawings and samples and procurement of materials and construction activities.
6. Government activities that affect progress shall be shown. These include but are not limited to: Notice-to-Proceed, approvals, and inspections.
7. The schedule logic shall be developed and maintained so that all activities, other than project start and completion, shall have a successor activity and a predecessor activity.
8. Identify how much lag time is in the schedule and how many severe weather days are included in the initial schedule.

**NO PHYSICAL CONSTRUCTION WORK AT THE SITE MAY TAKE PLACE UNTIL THE CONTRACTOR SUBMITS AND THE GOVERNMENT APPROVES THE SCHEDULE.**

Government review of schedule submittal(s) will not exceed thirty (30) calendar days.

Resubmittal, if necessary shall not exceed fourteen (14) calendar days.

- E. Two-week "Look Ahead" schedule - This schedule may be of the contractor's choosing, either bar chart or CPM form. Only activities scheduled to be occurring during the forecasted two week time periods are to be shown. Schedules shall be submitted weekly. Early and Late Start and Finish dates, and subcontractors involved are data to be included in the schedule.
- F. Submittals - Submit shop drawings, material and equipment lists, and all other data required under various headings of these specifications necessary to permit commencement of work. RE will return the submittals within 30 calendar days after receipt, indicating approval or disapproval.
- G. Submittal Preparation - Place a permanent label or title block on each submittal for identification. Indicate the name of the entity that prepared each submittal on the label or title block.
  1. Transmittals - All submittals shall be accompanied by transmittal letters identifying the contents of the submittal. It shall be clearly indicated on the transmittal letter with a statement and signature of the Contractor that the submittal item was verified for compliance with the contract requirements and approved by the Contractor. Transmittal letters shall consist of one original.

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2. Contents - Submittals shall be complete and detailed and assembled into sets. Lack of completeness or clarity or inadequate description will be justification for disapproval. Submittals shall bear the following information:
  - a) Name of project or facility and contract number;
  - b) Date of submission;
  - c) Contract drawing number and latest revision;
  - d) Specification page and paragraph number;
  - e) Name of contractor and subcontractor or supplier/manufacturer;
  - f) Clearly identified contents and location of work;
  - g) Any proposed variances to specification requirements;
  - h) Contractor's approval certifying he checked and coordinated the work of other trades.

**1.5 SHOP DRAWINGS**

- A. Applicable Documents -
- B. Presentation - Present drawings in a clear and thorough manner. Identify details by reference to sheet and detail, building wing and section shown on contract drawings.
  1. Submit newly prepared information drawn accurately to scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Standard information prepared without specific reference to the Project is not a Shop Drawing.
  2. Shop Drawings include fabrication and installation Drawings, setting diagrams, schedules, patterns, templates and similar Drawings.
- C. Contents - Provide the following information on each submittal:
  1. Submittal number (paragraph 2.1 of this Section) and identify as "Part A" or "Part B" item
  2. Date of submission
  3. Name of project and facility (full name)
  4. Name of Contractor or Subcontractor
  5. Reference to drawing number (with revision, if applicable) and/or specification section.
  6. Clearly identify contents and location of work.
  7. Contractor's approval certifying he checked and coordinated the work of other trades.
  8. Dimensions.
  9. Identification of products and materials included by sheet and detail number.
  10. Compliance with specified standards.
  11. Notation of coordination requirements.
  12. Notation of dimensions established by field measurement.

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13. Sheet Size: Except for templates, patterns and similar full-size Drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches but no larger than 36 by 48 inches.
- D. Submittal - Submit blue- or black-line prints for the RE's review. Submit five copies, of which three will be retained by the RE.
  1. One of the prints returned shall be marked up and maintained as a "Record Document."
  2. Do not use Shop Drawings without an appropriate final stamp indicating action taken.

**1.6 PRODUCT DATA**

- A. Collect Product Data into a single submittal for each element of construction or system. Product Data includes printed information, such as manufacturer's installation instructions, catalog cuts, Material Safety Data Sheets (MSDS), standard color charts, roughing-in diagrams and templates, standard wiring diagrams, and performance curves, for all materials brought on site.
- B. Preparation
  1. Clearly mark or highlight each copy to identify pertinent site specific products or models the Contractor intends to use
  2. Highlight/clearly indicate all performance characteristics and capacities
  3. Highlight/clearly indicate all dimensions and clearances required

Note: If the submittal is not clearly marked, regarding the above pertinent data, the submittal will be returned marked "DISAPPROVED".

**1.7 WARRANTIES/GUARANTIES**

- A. Assemble two (2) copies with original signatures of warranties executed by each of the respective manufacturers, suppliers, and subcontractors into a warranty book and prepare a Table of Contents.
- B. Additional Data - Provide complete information for each item, include the following:
  1. Product or work team
  2. Firm, with name of principal, address, and telephone
  3. Scope
  4. Effective dates of warranty based on Final Acceptance of the item.
  5. Information for owner's personnel on proper procedures to evoke the warranty in case of failure and instances which might affect the validity of warranty
- C. Warranties - Effective after project completion and acceptance by the FAA.



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**1.8 CERTIFICATES**

Assemble certificates executed by each of the respective manufacturers, suppliers, and subcontractors.

A. Additional Data - Provide complete information for each item to certify compliance with contract documents.

1. Product or work item
2. Firm, with name of principal
3. Scope of compliance
4. Signature by an officer of the manufacturer or other individual authorized to sign documents on behalf of the company.

**PART 2 – MATERIAL**

**NOT USED**

**PART 3 – EXECUTION**

**3.1 GENERAL**

Submittals are required for, but not limited to, the items listed in the specifications or on the drawings. The following is a partial list of submittals required: Schedules, Manufacturer's Literature, Shop Drawings, Samples, Test Reports, Warranties, Certificates, Design Calculations, MSDS, and Installation Instructions. This list should not be construed as a complete list of all submittals required. Submittal dates shall comply with this specification unless a more stringent date is specified. Substitutions and all requested changes will require a submittal.

**3.2 SCHEDULE FOR CRITICAL SUBMITTALS**

**Process after the construction contract has been awarded and prior to NTP:**

All Critical Submittals are due 30 calendar days after the contract has been awarded. See below for a list of critical submittals. The construction Notice to Proceed (NTP) will not be issued until all critical submittals are approved. All other submittals shall be submitted and approved prior to installation or construction. Critical submittals include the following:

1. Section 01300 - Construction Schedule
2. Section 15900- Leak Detection Panels and accessories and DDC Controls

No later than two weeks after the contract has been awarded, the Contractor shall be available to participate in a meeting/telecom with the Contracting Officer, Resident Engineer and Office Project Engineer to discuss and coordinate the following:

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- 1) Contractor's FAA point of contact for submitting the Critical Submittals.
- 2) Discuss the submittal process and forms.
- 3) Discuss process and forms for request of FAA security badges.
- 4) Discuss the proposed date for Notice to Proceed (NTP)

**PART 4 – QUALITY ASSURANCE**

**NOT USED**

**\* \* \* END OF SECTION \* \* \***



## SECTION 01651 MATERIALS AND EQUIPMENT

## PART 1 - GENERAL

## 1-1 SUMMARY

A. General. - Material and equipment incorporated into the work shall conform to applicable specifications and standards and comply with size, make, type and quality specified, or as specifically approved in writing by the COR. Manufactured and fabricated products shall be designed, fabricated and assembled in accordance with the best engineering and shop practices. Like parts of duplicate units shall be manufactured to standard sizes and gages and shall be interchangeable. Two or more items of the same kind shall be identical and manufactured by the same manufacturer. Products shall be suitable for service conditions. Equipment capacities, sizes and dimensions shown or specified shall be adhered to unless variations are specifically approved in writing. Do not use material or equipment for any purpose other than for which it is designed or specified. Furnish and install products specified, under options and conditions for substitution stated in this section.

1. Manufacturer's instructions. - When contract documents require that installation of work shall comply with manufacturer's printed instructions, copies of such instructions shall be distributed to parties involved in the installation, including two copies to the COR. Maintain one set of complete instructions at the job site during installation and until completion. Products shall be handled, installed, connected, cleaned and conditioned in strict accordance with such instructions and in conformity with specified requirements. If job conditions or specified requirements conflict with manufacturer's instructions, the contractor shall consult with the COR for further instructions. All work shall be performed in accordance with manufacturer's instructions. No preparatory step or installation procedure shall be omitted unless specifically modified or exempted by contract documents.
2. Transportation and handling. - Products shall be delivered in undamaged condition, in manufacturer's original containers or packing, with identifying labels intact and legible. Shipments shall be inspected to ensure compliance with requirements of contract documents and approved submittals, and products are properly protected and undamaged immediately on delivery. Provide equipment and personnel to handle products by methods to prevent soiling or damage to products or packing.
3. Storage. - Unless specified, products shall be stored in accordance with manufacturer's instructions, with seals and labels intact and legible. Products subject to damage by the elements shall be stored in weather tight enclosures.
4. Temperature. - Temperature and humidity shall be maintained within the ranges required by the manufactures instructions. Fabricated products shall be stored above the ground, on blocking or skids to prevent soiling or staining. Products which are subject to deterioration shall be covered with impervious sheet coverings and adequate ventilation shall be provided to avoid condensation.
5. Substitutions. - A separate request for each substitution shall be submitted. Each request shall be supported with complete data substantiating compliance of proposed substitution with the requirements stated in the contract documents. Each request shall include product identification, manufacturer's literature including address, product description, reference standards and performance and test data. Samples shall be submitted as applicable. An

itemized comparison of the proposed substitution with the product specified shall be included. The following information shall also be included: data relating to changes in the construction schedule; list of changes required in other work or products; and accurate cost data. Substitute products shall not be ordered or installed without written acceptance. In making a formal request for substitution, the contractor represents that he has investigated the proposed products and has determined that it is equal to or superior in all respects to that specified. The contractor ascertains that he will provide same warranties or bonds for substitutions as for product specified. That he will coordinate installation of accepted substitution into work to be complete in all respects; that he waives claims for additional costs caused by substitution which may subsequently become apparent; and that cost data is complete and includes related costs under his contract. Primarily, an "or equal" product will not be considered a substitution. If an actual substitution is accepted, it shall be done only by formal contract modification and not by a submittal approval.

6. New equipment and materials – All contractor supplied materials and equipment that will remain in the government's custody after contract completion, shall be new. Refurbished and or used equipment and materials are disallowed for construction purposes under this contract.

END OF SECTION 01651

\* \* \* \* \*

SECTION 01652 PROTECTION OF WORK

PART 1 - GENERAL

1.1 SUMMARY

- A. Requirements Included. - It shall be the Contractor's responsibility to provide protection of work from weather, physical damage, improper use, and other adverse natural conditions. It shall be the responsibility of the Contractor to replace any damaged work including finishes, material, and equipment.

1.2 RELATED REQUIREMENTS. - The Respective Section of the Specification covering items of work.

Section 01651: Materials and Equipment

Section 01710: Cleaning

B. Protection during Installation.

1. Sleeves. - Provide watertight closures for sleeve openings below grade.
2. Building Openings. - Provide protection of temporary openings in the building to completely protect the contents and enable work to progress, during winter and all weather conditions. The method and means shall be subject to approval by the COR.
3. Base Materials. - Provide protection of base materials to receive finishes from physical damage.
4. Protection after Installation. - Provide protection of installed products and finished surfaces to prevent damage from subsequent operations. Remove when no longer needed, prior to completion of work.
5. Floors and Stairs. - Protect finished floors and stairs from dirt and damage:
  - (a) In areas subject to foot traffic, secure heavy sheathing in place.
  - (b) For movement of heavy products, lay planking or similar materials in place.
  - (c) For storage of products, lay tight wood sheathing in place.
6. When some activity must take place in order to carry out the contract, obtain and abide by recommendations of installer for protection of surface. Remove upon completion of the activity.

END OF SECTION 01652

\* \* \* \*



SECTION 01710      CLEANING

PART 1 - GENERAL

1-1      SUMMARY

The scope of this project will be performed in a partially occupied special use environment. Daily cleaning and protection of critical electronic equipment shall be a requirement. All prospective bidders are encouraged to visit the project site to ascertain the criticality of maintaining a clean and dust free environment.

A. Requirements Included.

1. Execute cleaning during the progress of work. This includes but not limited to the following:
  - a) Wipe all surfaces within the limits of work at the end of each shift.
  - b) Vacuum all floors where work took place.
  - c) Remove temporary protective covers at the end of each shift.
2. Execute cleaning for final inspection.
3. Execute cleaning at completion of the work.

1-2      RELATED REQUIREMENTS

Section 01651: Materials and Equipment  
Section 01800: Contract Closeout.

1-3      PRODUCTS

- A. Materials. - Use only those cleaning materials recommended by the manufacturers of the surface being cleaned so as not to create hazards to health or property.

1-4      EXECUTION

- A. Disposal Requirements. - Conduct cleaning and disposal operations to comply with codes, ordinances, regulations, and anti-pollution laws.
- B. Dust Control.
1. Clean interior spaces prior to the start of finish painting and continue cleaning on as needed basis until painting is finished.
  2. Schedule operations so that dust and other contaminants resulting from the cleaning process will not fall on wet or newly-coated surface.
- C. Final Cleaning.
1. Employ skilled workmen for final cleaning.
  2. Remove grease, mastic, adhesive, dust, dirt, stains, fingerprints, labels, and other foreign materials from visible interior and exterior surfaces.
  3. Ventilating system:
  4. Clean permanent filters and replace disposable filters if units were operated during construction. Do not operate blowers and coils without filters during construction.
  5. Broom clean exterior paved surfaces, repair damaged sod areas with sod and rake. Clean other surfaces of the grounds.

6. Prior to final completion, or owner occupancy, Contractor shall conduct an inspection of interior and exterior surfaces, and all work areas to verify that the entire work is clean.
  7. Wax and polish tile floors affected by construction.
- D. During Construction. - Maintain all areas under Contractor's control free of extraneous debris. Conduct a specific maintenance program to prevent accumulation of debris at the construction site, storage and parking areas, and along access roads and haul routes.
- E. CERAP Operational Areas. - Clean up after each work shift.
- F. Debris Collection. - Provide containers for debris deposit and schedule periodic collections and disposal of debris. Provide additional collections whenever the periodic schedule is inadequate to prevent accumulation.

END OF SECTION 01710

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SECTION 01720 OPERATIONS AND MAINTENANCE MANUALS

PART 1 – GENERAL

1.1 SUMMARY

- A. The Construction Contractor shall furnish five original copies of the manufacturers' Operations and Maintenance (O&M) manual for equipment as specified. One complete O&M data manual shall be furnished prior to the time that equipment acceptance tests are performed. The remaining O&M data shall be furnished before the contract is completed. O&M data may be prepared by the equipment manufacturer and shall be submitted by the Contractor to the Contracting Officer's Representative (COR) as specified.

O&M instructions shall be legible and easy to read, with large drawings (when used), folded into the manual. Specific O&M data to be submitted shall, but not limited to, all approved project submittals and vendor data.

PART 2 - PRODUCTS

2.1 CONTENTS

- A. The equipment manufacturers' operations and maintenance data shall contain, as a minimum, the following information as applicable:
- (a) Front matter
  - (b) Introduction
  - (c) Preparation for use of equipment
  - (d) Principles of operation
  - (e) Operating instructions
  - (f) Maintenance and servicing instructions
  - (g) Parts list
  - (h) Repair and overhaul instructions
  - (i) Warranty documents

2.2 FRONT MATTER

The front matter consists of a cover or title page, table of contents, and safety precautions.

- A. COVER. - The cover shall include the following identification: "OPERATIONS AND MAINTENANCE MANUAL", and include the name of the equipment, system, or facility component, the name of the Contractor, contract number, and date the manual was prepared.
- B. TITLE PAGE. - The title page shall contain the same information as the cover, and the following additional information: Names, addresses, phone numbers, and principal contact for each contractor and subcontractor installing the equipment, and the equipment manufacturer's local representative for each item of equipment.



- C. TABLE OF CONTENTS. - The manual shall contain a table of contents. The table shall list all parts, chapters, sections, and paragraph numbers in the order of presentation used in the text. It shall include a list of illustrations and a list of tables, whenever they are included in the manual.
- D. SAFETY PRECAUTIONS. - The manual shall contain safety precautions where hazards may be present during installation, operation, or maintenance of the equipment. Hazards may include, but are not limited to; presence of high voltage, electrostatic discharge, radio frequency radiation, radioactive materials, the presence of poisonous fumes or explosive gases, and the depletion of oxygen in a closed environment. During preparation of the narrative for equipment installation, operation, or maintenance; the point in the narrative where the hazard may be encountered shall be preceded by a hazard warning or caution statement.

## 2.3 INTRODUCTION

The manual shall contain an introduction containing the following:

- (a) Purpose and functions of equipment.
- (b) Capabilities.
- (c) Performance characteristics.
- (d) Description; including model number, dimensions, weight, volume, and center of gravity, when applicable.
- (e) Power and utility requirements.
- (f) Environmental limitations.
- (g) List of items furnished with equipment.
- (h) List of additional items required for operation and maintenance, but not supplied with equipment.
- (i) Handling precautions and special storage requirements.
- (j) Warranty information.

## 2.4 INSTALLATION AND PREPARATION FOR USE INSTRUCTIONS

The manual shall contain unpacking, re-installation and assembly instructions that may be used during maintenance operations in the event that the installed equipment must be replaced. The instructions shall include requirements for wiring, plumbing, initial lubrication, alignment, and checkout as applicable.

## 2.5 PRINCIPLES OF OPERATION

The manual shall contain principles of operation technical information suitable for the intended user.

## 2.6 OPERATING INSTRUCTIONS

Operating instructions shall include:

- (a) Illustrations and explanations for all controls and indicators, including settings and readings when applicable.
- (b) Initial adjustment and control settings.
- (c) Equipment start-up procedures.
- (d) Normal equipment operation.
- (e) Operation under emergency, adverse, or abnormal conditions.
- (f) Shut-down procedures.
- (g) Emergency shut-down procedures (when required).



## 2.7 MAINTENANCE AND SERVICING INSTRUCTIONS

Maintenance and servicing instructions shall be provided for both preventive and corrective maintenance. Instructions shall include a list of test equipment, special tools, and materials needed for maintenance and service. This list shall include nomenclature, part/model number, application, range, and accuracy. Instructions should include illustrations to show how test connections are made. Actions and normal indications shall be shown for each test.

- A. Cleaning and inspection. - Periodic cleaning and lubrication information including types of cleaning agents and lubrication, and the frequency of lubrication and inspection intervals shall be included. Lubrication points and the type and quantity of lubrication shall be identified. Photographs or illustrations shall be included that clearly show the location of lubrication points.

Cleaning and lubrication required during repair and overhaul shall be included in those appropriate sections.

- B. Performance verification. - For equipment that must be calibrated or certified to performance standards, instructions for performing the test shall be included.

Instructions for the calibration of the test, measurement, and diagnostic equipment needed to restore the equipment to performance verification shall be provided. These instructions shall be step-by-step procedures that will enable the user to check the accuracy of the measurements or readings. The location of all test connections and the values expected at these points shall be included. Data shall include the recommended frequency of adjustments and the verification checks required.

- C. Inspection. - Instructions for inspection of equipment and frequency of inspection for damage and wear shall be provided with emphasis on allowable service limits such as wear, backlash, end play, balance, voltage, resistance, pressure, and/or length and depth of scoring.

- D. Troubleshooting. - Equipment malfunctions that may occur during operation shall be identified. Equipment troubleshooting data and fault isolation techniques shall include:

- (a) An indication or symptom of trouble.
- (b) The instructions necessary, including test setups, to determine the cause of the problem.
- (c) The action required to restore equipment to operating condition.

The troubleshooting information shall be in a chart, logic tree, or tabular format with appropriate headings, or as a logic, block, or schematic diagram. Troubleshooting data shall include instructions suitable for identifying the lowest replaceable unit (LRU) that when removed and replaced will restore the equipment to operation.

- E. Disassembly, repair, replacement, and reassembly. - Instructions shall be provided that describe the sequential disassembly, repair, replacement, and reassembly of equipment. Test, adjustment, and checkout data after reassembly shall be provided. Illustrations including exploded views shall be provided as necessary to support these functions.

- F. Reprogramming. - A description of re-programmable memory, reprogramming theory, program setup, program confidence checkout, program loading, and programming procedures shall be provided for equipment having a programmable memory.

- G. Preparation for shipment. - Equipment that must be returned to the equipment manufacturer or a repair depot for repairs that cannot be performed at the installed location, shall be furnished with appropriate preparation for shipment instructions.

## 2.8 PARTS LIST

The manual shall include a parts list containing positive identification of parts in the equipment item.

- A. Illustrated parts list. - Clear and legible illustrations shall identify component parts and parts relationship.
- B. Parts listing. - Part names and part numbers shall be shown on illustrations or tables. When the illustrations do not contain both part numbers and part names, the illustrations and the separate listing shall show either index reference, or key-numbers that cross-reference from the illustrated parts to a parts list. The parts list shall identify the actual manufacturer/vendor and the part number or generic description. Parts in the listing shall be grouped by assemblies, subassemblies, and modules with the parts identified to the assembly from which they are components.
- C. Common commercial parts. - Common commercial hardware and items that are not of special design such as bolts, washers, nuts, screws, fittings, keys, hinges, wire, cable, gasket material, tubing, and hose that are available from a wide range of sources shall be identified by part number or the notation "Commercial" instead of a part number. The part name including nomenclature or description shall be complete enough to facilitate substitution of equivalent items as shown below:

Examples:

<u>Figure No.</u>	<u>Part No.</u>	<u>Part Name (Nomenclature or Description)</u>
2-4	Commercial	Nut, hex head, plain steel, 1/4"-20 UNC-3BS
2-5	Commercial	Wire, electrical, copper tin plated, No. 14 AWG. 19 strands of No. 27 AWG, 0.250 in. dia.

- D. Recommended spare parts. - The equipment manufacturer or supplier shall provide a list of recommended spare parts that are required to support the operational use of the equipment for a one year time period. Recommended spare parts that are not "off the shelf" and have a delivery lead time greater than one month from receipt of order shall be so noted.

## 2.9 OPERATIONAL AND MAINTENANCE ILLUSTRATIONS

Manuals shall contain illustrations for locating and identifying all components significant to operations and maintenance. Line drawings, photographs or halftones shall show the configuration and parts relationship to aid in removal and disassembly procedures. Free hand sketches shall not be acceptable. Where appropriate, the manual shall contain the following diagrams:

- (a) Simplified functional block
- (b) Locator
- (c) Piping
- (d) Hydraulic



- (e) Schematic
- (f) Flow Control
- (g) Electrical
- (h) Process Flow
- (i) Instrumentation

Symbols used on illustrations or diagrams shall be ANSI standards or common to the trade or industry. Where nonstandard symbols are used, explanations shall be provided.

## 2.10 OVERHAUL INSTRUCTIONS

When applicable, the manual shall include overhaul instructions to return the equipment to full operational capability. As a minimum, the instructions shall include the following:

- (a) List of support equipment, special tools, and facilities required.
- (b) List of mandatory replacement parts.
- (c) Pre-shop analysis, as applicable.
- (d) Step-by-step procedures for performing all functions including disassembly, removing, replacing, diagnosing, installing, repairing, assembly, in-process testing, adjusting, and inspecting.
- (e) Final tests or certification required to assured satisfactory performance of the equipment or system overhaul.

## 2.11 EQUIPMENT WARRANTIES

The O&M manuals shall contain warranty documents for all equipment items that are listed in the manual. The warranty shall specify the time that the warranty is in effect from final turnover by the Contractor to the COR. The warranty shall also include:

- (a) Equipment name and description as marked on the equipment nameplate.
- (b) Name, address, phone number, and name of principal contact of the manufacturer or supplier.
- (c) Local authorized service agency of the manufacturer or supplier including name, address, phone number, and principal contact.
- (d) Manufacturer's warranty statement that specifies the scope of warranty coverage.
- (e) The manufacturer's specified method or procedure for obtaining warranty service.
- (f) Supplemental information regarding factors that might invalidate the warranty.

## PART 3 – EXECUTION (NOT USED)

END OF SECTION 01720

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# **INSTALL LEAK DETECTION IN AUTOMATION AND COMMUNICATIONS EQUIPMENT ROOMS**

SAN JUAN CERAP

**SEPTEMBER 2011**  
FAA-ZSU-1005706

## **SECTION 01730 - OSHA SAFETY REQUIREMENTS**

### **PART 1 – GENERAL**

#### **1.1 SCOPE**

- A. This section identifies some of the requirements of the OSHA Construction Standard.
- B. Formulation of a site specific safety plan

#### **1.2 CONTRACTOR RESPONSIBILITY**

- A. General Safety Provisions - The Contractor shall bear full responsibility to provide safe working conditions for its employees and Contractors. The Contractor shall not permit any employee or Subcontractor to work in surroundings or under working conditions that are unsanitary, hazardous, or dangerous to the health and safety of the employee.
- B. Accident Prevention - The Contractor shall bear the responsibility of maintaining an accident prevention program such that frequent and regular inspections of the job site, materials and equipment are made by a competent person designated by the employer.
- C. Use of Equipment - The Contractor shall not permit the use of any machinery, tool, material, or equipment that is not in compliance with OSHA regulations. The employer shall permit only those employees qualified by training and/or experience to operate equipment and machinery.

#### **1.3 SUBMITTALS**

- A. Submittals required include, but are not necessarily limited to, the following:

##### **1. Contractor Safety Plan**

#### **1.4 CONTRACTOR RESPONSIBILITY**

- A. The FAA shall not be held responsible for safety inspections to assure Contractor conformance with the OSHA safety regulations. The FAA, however, reserves the right to notify the Contractor of any deficiencies regarding worker safety.
- B. The FAA will evaluate the Contractor on its safety performance, including that of its Subcontractors. The number and severity of safety and security violations will be considered in this evaluation. Contractor safety violations are cause for termination for default, may result in notification of the Contractor's bonding company, and will affect the Contractor's opportunity to propose on future work. Failure to correct such deficiencies may impact the Contractor's ability to work on future FAA contracts.

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### **1.5 OSHA REGULATIONS**

- A. The Contractor shall comply with the latest Occupational Safety and Health Administration regulations (CFR 29 Part 1926) regarding safety in the work area.
- B. The Contractor shall be responsible for obtaining copies of non-FAA referenced documents without additional cost to the FAA. If Contractor requests a copy of FAA directives, they may be obtained by contacting the Contracting Officer.
- C. The Contractor is not relieved from adhering to other OSHA requirements not listed herein. The Contractor shall consult the latest referenced OSHA documents for safety regulations.
  - 1. Documents:
    - a) OSHA Documents:
      - 1) CFR 29 Part 1926 Safety and Health Regulations for Construction
      - 2) CFR 29 Part 1910 General Industry Standards Applicable to Construction Industry
    - b) FAA Documents:
      - 1) FAA Order 3900.49 Control of Hazardous Energy During Maintenance, Servicing and Repair

### **1.6 SAFETY PLAN**

The contractor must develop and implement a site specific comprehensive Health and Safety Plan (HASP) based on the scope of work, for his or her employees as well as others in the area and the properties around. It shall cover all aspects of onsite construction operations and activities associated with the contract. This plan must comply with 29 CFR 1926, FAA Order 3900.19B, other applicable health and safety regulations and any project-specific requirements. The contractor must provide the Contracting Officer with a copy of this plan. Acceptance of the contractor's HASP only signifies that the plan generally conforms to the requirements of the contract. It does not relieve the contractor of the responsibility for providing with a safe and healthful work environment. At a minimum the HASP shall address the following:

- A. Workplace address
- B. Name and address of the principal contractor
- C. Key Personnel, phone nos and addresses
- D. Estimated duration of the work
- E. Hazard assessment and identification of the hazards in the scope of work
- F. Mitigation of hazards and proposed control measures for the risks

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- G. Hazard Communication methods
- H. How the controls will be implemented
- I. Personal Protective Equipment
- J. Training
- K. Temperature Extreme
- L. Medical Surveillance
- M. Exposure Monitoring and Air Sampling
- N. Site Control
- O. Emergency Response/Contingency Plan
- P. Emergency Action Plan
- Q. Confined Space Entry
- R. Spill Containment
- S. Documentation and Record Control
- T. Arrangements for monitoring and reviewing controls
- U. Lock-out and Tag-out

The plan must be written so it is easy to understand, signed and dated by the General Contractor. It must be available for the length of the project. The General Contractor cannot allow work to start unless the plan has been discussed with or a copy given to all relevant people and the plan is readily available for inspection. The plan must be amended if there are changes in how risks will be managed. The General Contractor must inform any affected person of the change.

## **PART 2 – MATERIAL**

NOT USED

## **PART 3 – EXECUTION**

### **3.1 CFR 29 PART 1926 - SAFETY AND HEALTH REGULATIONS FOR CONSTRUCTION**

- A. This section contains a partial listing of the referenced OSHA standards. The Contractor is responsible for adhering to all applicable regulations including those not specifically referenced herein.



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1. Subpart D (Occupational Health and Environmental Controls) - Contractor shall furnish adequate supply of potable water in containers clearly marked as potable water. Containers containing non-potable water shall be clearly marked. Contractor shall furnish toilet facilities based on the number of employees present on the job-site. A minimum of 1 facility is required for less than 20 employees. See CFR 29 Part 1926 Subpart D for complete requirements.
2. Subpart E (Personal Protective Equipment) - The Contractor shall provide adequate protection for the head, hearing, and eyes for all employees working in an area where hazards to the head, ear and eyes exist. See CFR 29 Part 1926 Subpart E for complete requirements.
3. Subpart I (Tools) - All hand tools and power tools and similar equipment whether furnished by the Contractor or the employee shall be maintained and operated in a safe condition. Personal protection shall be used when applicable. The use of tools shall be limited to the intended use of said tools. See CFR 29 Part 1926 Subpart I for complete requirements.
4. Subpart K (Electrical) - The Contractor shall furnish ground fault protection for all electrical equipment used on the jobsite. Extension cords shall be three wire ground in good shape. Installation of the facilities will require energizing numerous circuits. The Contractor shall protect against electrical shock by methods such as posting warning signs, supplying insulated gloves, locking out and tagging de-energized circuits, and other similar methods. See CFR 29 Part 1926 Subpart K for complete requirements.

### 3.2 CFR 29 PART 1910 - GENERAL INDUSTRY STANDARDS APPLICABLE TO CONSTRUCTION INDUSTRY

- A. This section contains a partial listing of the referenced OSHA standards. The Contractor is responsible for adhering to all applicable regulations including those not specifically referenced herein.
  1. Section 1910.147 - Contractor shall maintain a written hazardous energy control procedure in accordance with CFR 29 1910.147. The written procedure shall describe contractor's responsibilities regarding shift changes or personnel changes. A specific coordinated lockout/tagout procedure shall be recorded in writing and signed by the Contractor and Contracting Officer with copies to each party.
  2. Section 1910.120 - The Contractor shall develop and implement an Emergency Response and Contingency Plan in accordance with OSHA Standard 29 CFR 1910.120. In the event of an emergency associated with remedial action, the Contractor shall, without delay, take diligent action to remove or otherwise minimize the cause of the emergency; alert the Contractor; and institute whatever measures might be necessary to prevent any repetition of the conditions of actions leading to, or resulting in, the emergency. Emergency contact names and telephone numbers shall be posted at all project phones and in site-support vehicles as well as included within the plan.

## PART 4 – QUALITY ASSURANCE

NOT USED

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\* \* \* END OF SECTION 01730 \* \* \*

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Section 01740 Division I Safety and Health Requirements

1. Objectives and Responsibilities

The objectives of the safety and health requirements are to eliminate contractor generated facility shutdowns, interruptions, injuries, illnesses, and incidents. When the Contractor is notified by the Contracting Officer Technical Representative (COTR) of non-compliance with the safety or health provisions of the Contract, the Contractor shall immediately, unless otherwise instructed, correct the unsafe act or unsafe condition.

It is the contractor's responsibility to understand the work to be performed, perform the work in a professional manner and to protect his workforce and FAA from incidents.

2. Communication

A. All contractor tasks must be communicated to FAA prior to the tasks being performed.

A1. Preconstruction Safety Meeting

The FAA will schedule a preconstruction meeting after the Notice to Proceed. The agenda will include:

1. The FAA will identify the Contracting Officer Technical Representative (COTR) and Resident Engineer (RE). The contractor will identify his site management.
2. The FAA will review the chain of authority.
3. The FAA will review the procedure to process field decisions and change orders.
4. The FAA will review the facility safety procedures, and safety and health requirements.
5. The FAA will discuss schedules, shop drawings, product data and samples, manufacturer's certifications of products, manpower reports, equipment deliveries and priorities schedules, procedures for maintaining record documents, use of FAA facilities by contractor (access, parking, office area, and storage area), safety and first aid procedures, security procedures and housekeeping procedures.

A2. Monthly Project Schedule

A detailed schedule must be submitted to FAA monthly. The date the schedule is due will be identified during the preconstruction safety meeting.

A3. Three Week Look-Ahead Schedule

A detailed three week look-ahead schedule must be submitted to FAA weekly. The date the schedule is due will be identified during the preconstruction safety meeting.

A4. Daily Project Scope and Schedule



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A detailed daily project scope and schedule must be submitted to the FAA daily. Usually the daily scope and schedule meeting is held early morning with the FAA Resident Engineer. Hot work permits, and electrical/pneumatic/water and steam lockouts are issued daily.

All safety related schedules should be coordinated with the over all work scheduled required in the specifications.

3. Task Specific Safety and Health Plans

All tasks are to be planned and scheduled. All plans must be written and submitted for FAA approval before tasks are performed. The safety and health plan must be compliant with federal safety and health standards (29 CFR 1910 General Industry, 29 CFR 1926 Construction Industry, applicable state safety and health regulations and FAA Orders including Order 3900.19B, Occupational Safety and Health Program. Asbestos containing materials, lead containing coatings, polychlorinated biphenyls, noise and odors are to be controlled.

Required elements of the safety and health plan must include:

1. Coordinate the Safety and Health Plan with the Project Work Plan.
2. Tasks are to be described in detail. All physical and chemical hazards identified, and engineering controls are to be incorporated to eliminate or reduce the hazard.
3. An Emergency Response Plan must be assembled including, where applicable, consideration for fire, explosion, toxic or oxygen deficient atmospheres, water leakage, electrical hazards, slips, trips and falls, confined spaces, heat/cold stress, noise, and odors.
4. Material Safety Data Sheets (MSDS) must be submitted to FAA for all chemicals brought on-site by the Contractor before the chemical is brought on-site.
5. The safety and health plan must include the personal protection equipment to be donned. Hard hats (ANSI Z89.1 or equivalent) must be worn at all times where overhead hazards exist regardless of the workers activities. Shirts with at least four-inch sleeves and appropriate pants shall be worn. Tank tops and shorts are not permitted. Loose or frayed clothing, loose or hanging long hair, ties, rings, body jewelry shall not be worn around moving machinery or other areas where they may become tangled. High visibility shirts, vests, or coats (ANSI/ISEA 107-2004) must be worn at all times while on the project site. Hearing protection must be worn when exposures exceed 85 dBA-TWA. Hard-toe footwear (ASTM F2413, or equivalent) must be worn by all workers when in the construction environment or in areas where there is a danger of foot injuries due to falling, rolling, or piercing objects. Safety glasses with rigid side shields (ANSI Z87.1, or equivalent) must be worn at all times when in the construction environment and in any area where eye hazards exist. Gloves, appropriate for the hazard, must be worn when hands are exposed to physical or chemical hazards.
6. There is a 100% Fall Protection Policy at FAA facilities. Anytime employees are working from an unprotected elevation of six feet or more, fall protection must be incorporated. Working means while traveling, stationary, or at anytime exposed to a fall from a surface not protected by approved handrails, guardrails or some other

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- approved fall prevention device. Workers in mechanical lifts, including scissor lifts, boom trucks, suspended or supported personnel baskets, articulating lifts, and other similar devices must use fall protection equipment at all times.
7. Equipment and tools must not be altered in any way to adapt it for a job for which the manufacturer does not intend it.
  8. All hand-held power tools must be equipped with constant pressure switches that will automatically shut off power when the pressure (worker's hand) is removed. Hand-held power tools with on/off or lock-on switches are not permitted.
  9. Ground Fault Circuit Interrupters must be used to protect all temporary electrical wiring and cord sets.
  10. Lock-out/tag-out procedures must be followed to minimize the potential exposure of workers to hazardous energy. Only FAA will energize or deenergize facility electrical circuits. The contractor will connect to temporary power panels only unless specifically approved by FAA. Only FAA will turn on or turn off hot water, chilled water, and steam valves.

Job Hazard Analysis

At the beginning of each work shift, a Job Hazard Analysis/Activity Hazard Analysis or equivalent must be completed jointly by contractor management and craft employees before the work task is performed. Each employee must sign off that they understand the task to be performed, the hazards associated with the task, the controls and PPE required for the task. A copy of the signed off JHA must be transmitted to the FAA daily.

4. Orientation and Training

All contractor employees must complete a site and task specific orientation and test provided by the Contractor prior to tasks in FAA facilities.

Daily Safety Meetings or Tool Box Meetings are to occur before each work shift and include all contractor on-site employees.

5. Incident Investigation

All contractor incidents will be communicated immediately to the FAA Resident Engineer and investigated by the contractor. An incident report and Lesson Learned must be assembled for all incidents and transmitted to the FAA for review.

6. Auditing and Inspections

The contractor must conduct safety and health inspections by qualified and competent professionals at a frequency sufficient to identify and control task specific hazards.



## SECTION 01800 CONTRACT CLOSE OUT

### PART 1 - GENERAL

#### 1.1 SUMMARY

The contractor shall require each subcontractor engaged upon the work to bear full responsibility for cleaning up during and immediately upon completion of his work. All rubbish, waste, tools, equipment and other apparatus caused by or used in the execution of his work shall be removed. This shall in no way be construed to relieve the contractor of his primary responsibility for maintaining the building and the site clean and free of debris, and leaving all work in a clean and proper condition acceptable to the COR. All exposed floor surfaces shall be protected against all mechanical damage, mortar or plaster droppings, oil, grease, or other damage that will stain or soil the finish. Protection shall be maintained until all work has been completed.

- A. Rubbish removal. - Immediately after unpacking, all packing material, case lumber, wrappings, or other rubbish, flammable or otherwise, shall be collected and removed from the building and the premises.
- B. Overall cleaning. - Immediately before the final inspection, the entire exterior and interior of the building and the surrounding areas shall be thoroughly cleaned by the contractor, including but not limited to the following:
  - 1. All construction facilities, debris and rubbish shall be removed from the building and the site.
  - 2. All finished surfaces disturbed by this construction shall be swept, dusted, vacuumed, washed or polished as required.
  - 3. All tools, scaffolding, temporary utility connections or buildings, belonging to the contractor or used under his direction shall be removed from the site.

#### 1.2 PROJECT RECORD DOCUMENTS

- A. Maintenance of documents. - The following documents shall be maintained at the project site:
  - 1. Contract drawings
  - 2. Contract specifications
  - 3. Addenda
  - 4. Reviewed shop drawings
  - 5. Change orders
  - 6. Field test reports
  - 7. Project correspondence
  - 8. Software information specific to this project
  - 9. Other modifications to contract
- B. Storage and use of documents. - Store record documents apart from documents used for construction; do not use record documents for construction purposes. Keep documents in clean, dry, legible condition; provide file cabinets and racks for storage of drawings.
- C. Marking devices. - Use red colored pencil for all marking.



- D. Recording and labeling. - Label each document "Project Record" in 1-inch high printed block letters. Keep record documents current. Do not conceal or cover up any item of work until the information has been recorded.
- E. Submittals. - At completion of project, deliver record documents to COR. Accompany submittal with transmittal letter containing the following:
  - 1. Date
  - 2. Project title and number
  - 3. Contractor's name and address.
  - 4. Title and number of each record document
  - 5. Certification that each document as submitted is complete and accurate.
  - 6. Signature of contractor, or his authorized representative

### 1.3 CONTRACT DOCUMENTS

- A. Contract drawings. - Legibly mark to record actual construction:
  - 1. Horizontal and vertical location of underground and overhead utilities and appurtenances referenced to permanent surface improvements.
  - 2. Location of internal utilities and appurtenances concealed in construction referenced to visible and accessible features of structure.
  - 3. Field changes of dimension and detail.
  - 4. Changes made by change order or field order.
  - 5. Details not on originally specified drawings.
- B. Contractor specifications and addenda. - Legibly mark each section to record:
  - 1. Manufacturer, trade name, catalog number, and supplier of each item of equipment actually installed.
  - 2. Changes made by change order or field order.
  - 3. Other matters not originally specified.
- C. Shop drawings. - Shop drawings shall be maintained as record documents; legibly annotate drawings to record changes made after review.

### 1.4 COMPLETION CERTIFICATE

When the contractor considers the work complete, the contractor shall submit written certification that contract documents have been reviewed; work has been inspected for compliance with contract; equipment and systems have been tested in the presence of the RE and are operational. Second, the contractor also certifies that the required operational, and maintenance manuals, data, and parts list have been submitted and approved; spare parts have been provided as required; required instruction of maintenance personnel has been accomplished; work is completed, premises cleaned and ready for inspection; and the warranty certificates from all new equipment manufacturers have been provided.

### 1.5 FINAL INSPECTION

A written request for a final inspection shall be sent to the Resident Engineer fourteen (14) calendar days prior to the requested inspection date. The final inspection shall be scheduled at a mutually

agreed upon date, and will be acknowledged by the Resident Engineer. The contractor shall develop his own pre-final inspection and correct all deficiencies prior to requesting the final inspection. The pre-final report shall accompany the final inspection request.

If, during the final inspection, the Resident Engineer, in concurrence with the inspection team and the Contracting Officer, determines that the contractor was not ready for the final inspection, based on the contractor not meeting all of the contractual requirements, all costs incurred by the Government for additional inspections shall be deducted from the contract (including but not limited to: travel cost, per diem, salaries of all concerned parties, consultant engineer personnel, and FAA personnel required to participate in the final inspection). This dollar amount shall be the actual cost incurred by the FAA to perform the final inspection.

#### 1.6 PUNCH LIST

During the final inspection, the Resident Engineer, in coordination with the regional office and local FAA personnel shall develop a list (Punch List) of all deficiencies (unsatisfactory work, latent or patent defects, etc.). A copy of the punch list will be furnished to the contractor as a draft list after the final inspection, while the original copy will be forwarded to the Contracting Officer. Only one official punch list shall be generated by the inspection team.

The Contracting Officer will furnish to the contractor the official punch list within fourteen calendar days after completion of the final inspection. The contractor shall be allowed 30 calendar days to correct all deficiencies noted.

#### 1.7 ACCEPTANCE OF WORK

The contractor shall correct discrepancies noted during the final inspection, clean the premises, and notify the Resident Engineer that the work is ready for acceptance. The Resident Engineer shall verify that the official punch list has been accomplished and initialize and date each item as it is completed.

END OF SECTION 01800

\* \* \* \* \*

## SECTION 15080 - MECHANICAL INSULATION

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes pipe insulation jacket.

#### 1.2 REFERENCE STANDARDS

- A. American Society for Testing and Materials (ASTM)

1. A666: Specification for Annealed or Cold Worked Austenitic Stainless Steel Sheet, Strip Plate, and Flat Bar.
2. C534: Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
3. C518: Steady-state heat flux measurements and thermal transmission properties by means of the heat flow meter apparatus.
4. C552: Specification for cellular glass thermal insulation.
5. C553: Mineral fiber blanket thermal insulation for commercial and industrial applications.
6. C916: Adhesives for duct thermal insulation
7. C920: Elastomeric joint sealants.
8. C921: Specification for determining the properties of jacketing materials for thermal insulation.
9. C1071: Thermal and acoustical insulation (glass fiber, duct-lining materials).
10. C1136: Flexible, low permeance vapor retarders for thermal insulation.
11. E84: Standard test method for surface burning characteristics of building materials.
12. E96: Standard test methods for water vapor transmission of materials.
13. G21: Standard practice for determining resistance of synthetic polymeric materials to fungi.
14. G22: Standard Practice for determining resistance of plastics to bacteria.

- B. National Fire Protection Association (NFPA)

1. 255: Surface burning characteristics of building materials.

- C. Underwriters Laboratories(UL)

1. 723: Surface burning characteristics of building materials.



D. Federal Specifications (FS)

1. HH-I-558B: Insulation, blocks, boards, blankets, felts, sleeving (pipe and tube covering), and pipefitting covering, thermal (mineral fiber, industrial type).

E. Sheet Metal and Air Conditioning Contractors National Association (SMACNA)

1. Duct Liner Standards.

### 1.3 DEFINITIONS

- A. Hot Surfaces: Normal operating temperatures of 100 deg F or higher.
- B. Dual-Temperature Surfaces: Normal operating temperatures that vary from hot to cold.
- C. Cold Surfaces: Normal operating temperatures less than 75 deg F.
- D. Thermal resistivity is designated by an r-value that represents the reciprocal of thermal conductivity (k-value). Thermal conductivity is the rate of heat flow through a homogenous material exactly 1 inch thick. Thermal resistivity (r-value) is expressed by the temperature difference in deg Fahrenheit (Kelvin's) between the two exposed faces required to cause 1 BTU per hour to flow through 1 square foot at mean temperatures indicated.
- E. Thermal Conductivity (k-value): Measure of heat flow through a material at a given temperature difference; conductivity is expressed in units of BTU x inch/h x sq. ft. x deg F.
- F. Density: Expressed in pcf.
- G. Exposed Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms, and attic areas.
- H. Concealed Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings, in walls, and in duct shafts.
- I. Exposed Exterior Installations: Exposed to ambient outdoor conditions.

### 1.4 SUBMITTALS

- A. Prepare submittal data as specified in Section 01300, "Submittals." In addition, provide the following.
- B. Submit product data for insulation jacket type, adhesive, fastening devices, and finish to be used in the work. Include installation instructions for each type of insulation.
- C. Submit manufacturer's certification stating that products to be used meet fire rating criteria described in "Quality Assurance" article.
- D. Material test reports prepared by a qualified independent testing laboratory. Certify insulation meets specified requirements.
- E. Where laboratory test reports cannot be obtained, submit material certificates, signed by the manufacturer, certifying that materials comply with specified requirements.

- F. Submit Manufacturers Safety Data Sheets (MSDS) for products.
- G. Prepare and distribute operations and maintenance data as specified in Section 01782, "Operation and Maintenance Manual Data."

## 1.5 QUALITY ASSURANCE

- A. Fire Performance Characteristics: Conform to the following characteristics for insulation including facings, cements, and adhesives, when tested according to ASTM E84, by UL or other testing or inspecting organization acceptable to the authority having jurisdiction. Label insulation with appropriate markings of testing laboratory.
- B. Interior and Exterior Insulation: Flame spread rating of 25 or less and a smoke developed rating of 50 or less.
- C. Warranty: The Warranty shall include a service and parts warranty for one year from the date of acceptance of the installation, without charge to the FAA. After completion of the original installation, provide service and parts incidental to the proper performance of the equipment under the warranty for the period of one year. Calibrate and adjust the equipment provided under this contract. Place them in complete operating condition subject to the approval of the COTR.

## PART 2 - PRODUCTS

### 2.1 JACKETS

- A. PVC Jacketing: High-impact, ultra-violet-resistant PVC, 20 mils thick, roll stock ready for shop or field cutting and forming to indicated sizes. Jacket shall have a flame spread rating not exceeding 25 and a smoke development rating not exceeding 50 as determined by test procedures specified in ASTM E84, NFPA 255 and UL 723. Non white color shall be selected by COTR. Known Acceptable Source: Zeston 2000, Johns Manville.
- B. PVC Fitting Covers: Factory-fabricated fitting covers manufactured from 20 mil thick, high-impact, ultra-violet-resistant PVC. Jacket shall have a flame spread rating not exceeding 25 and a smoke development rating not exceeding 50 as determined by test procedures specified in ASTM E84, NFPA 255 and UL 723. Non white color shall be selected by COTR. Known Acceptable Source: Zeston 2000, Johns Manville.
- C. FSK Jacketing: FSK jacket shall be glass scrim reinforced laminate of aluminum foil and Kraft paper bonded together with a fire retardant adhesive, which acts as a vapor barrier in compliance with ASTM C1136, Type I requirements.
- D. ASJ Jacketing: ASJ jacket shall be white Kraft paper and aluminum foil laminate with the white Kraft paper facing out, which acts as a vapor barrier in compliance with ASTM C921, Type I requirements.

### 2.2 ADHESIVES

- A. Lagging Adhesive: ASTM 916 Type I, non-flammable water-based adhesive. Minimum service temperature range Minus 20 F to 180 F. Known Acceptable Source: Foster Products Spark-Fas WB 85-70.
- B. PVC Jacket Lap Adhesive: As recommended by jacket manufacturer.
- C. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A Type II Class I. Known acceptable source Foster Products 85-75.

### 2.3 SEALING COMPOUNDS

- A. Vapor Barrier Joint Compound: Water based, used on Cellular Glass Insulation joints.
  - 1. Water Vapor Permeance: 0.13 perms maximum, tested per ASTM E 96.
  - 2. Temperature Range: Minus 20 to 180 deg F.
  - 3. Known Acceptable Source: Foster Flextra 95-60.

### 2.4 MASTICS

- A. Vapor Barrier Mastic: Used on Cellular Glass Insulation where PVC fitting covers not available. Acrylic latex with 0.4 perm-in per ASTM E96.
  - 1. Known Acceptable Source:
    - a. Pittcote 404, Pittsburg Corning.
- B. Fiberglass Insulation Mastic: Water based.
  - 1. Known Acceptable Source:
    - a. Cold service mastic is Benjamin Foster 30-80.
    - b. Hot service mastic is Benjamin Foster 30-36.

### 2.5 ACCESSORIES AND ATTACHMENTS

- A. PVC Tape: 10 mils thickness, 30oz./inch adhesion to backing, 27 lb./in.-width tensile strength, used to seal PVC lap seams.
- B. Glass Cloth and Tape: Woven glass fiber fabrics, plain weave, presized a minimum of 8 ounces per sq. yd.
  - 1. Tape Width: 4 inches.
  - 2. Cloth Standard: MIL-C-20079H, Type I.
  - 3. Tape Standard: MIL-C-20079H, Type II.
- C. Polyester Fabric: For use with mastic on cellular glass. Polyester, minimum 2.78 oz. /sq. yd.
  - 1. Known Acceptable Source: PC fabric 79, Pittsburgh Corning.



- D. Anchor Pins: Capable of supporting 20 pounds each. Provide anchor pins and speed washers of sizes and diameters as recommended by the manufacturer for insulation type and thickness.
- E. Stainless steel thumb tacks: annular, serrated. For use on hot service insulation jackets.
- F. Bands: 3/4 inch wide, in one of the following materials compatible with jacket:
  - 1. Galvanized Steel: 0.005 inch thick.
  - 2. Aluminum: 0.007 inch thick.
- G. Wire: 14 gauge nickel copper alloy, 16 gauge, soft-annealed stainless steel, or 16 gauge, soft-annealed galvanized steel.
- H. Corner Angles: 28 gauge, 1 inch by 1 inch aluminum, adhered to 2 inches by 2 inches Kraft paper.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Surface Preparation: Clean, dry, and remove foreign materials such as rust, scale, and dirt.
- B. Chilled Water Pipe: Drain water from piping before installing insulation, to ensure complete dryness of pipe.
- C. Mix insulating mastic with clean potable water. Mix insulating cements contacting stainless-steel surfaces with demineralized water.
  - 1. Follow mastic manufacturer's printed instructions for mixing and portions.

### 3.2 JACKETS

- A. Insulation for Interior Low and High Temperature Piping, Valves, and Fittings: Install continuous PVC jackets with minimum 2 inch overlap at longitudinal and butt joints and seal with manufacturer recommended adhesive.
- B. The following is a list of the color coding to be used to identify PVC jacketing installed on this project:

TYPE/USE	COLOR
Chilled Water Supply	Blue
Chilled Water Return	Blue

### 3.3 REPLACE DAMAGED INSULATION

- A. Replace damaged insulation, which cannot be repaired satisfactorily, including units with vapor barrier damage and moisture saturated units.

### 3.4 REPAIR EXISTING INSULATION

- A. Repair damaged sections of existing mechanical insulation, which are damaged during this construction period. Use insulation of same thickness as existing insulation, install new jacket lapping and seal over existing.

### 3.5 PROTECTION OF INSULATION

- A. Protect insulation work during the remainder of construction period to avoid damage and deterioration.

END OF SECTION 15080

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SECTION 15900 DIRECT DIGITAL CONTROLS

PART 1 - GENERAL

1.1 RELATED SECTIONS

- A. The General Conditions of the Contract, Supplementary Conditions, and General Requirements are part of this specification and shall be used in conjunction with this section as part of the contract documents.

1.2 DESCRIPTION

A. Provide new leak detection systems for Automation and Communications Equipment Rooms as shown. Integrate with existing facility Direct Digital Control(DDC) system. New leak detection systems shall send an alarm to existing facility DDC system front end computer. Provide graphics and programming for existing front end computer. Coordinate with facility.

1.3 APPROVED CONTROLS SYSTEMS

Provide new controls compatible with existing facility DDC front end computer.

1.4 QUALITY ASSURANCE

- A. Installer and Manufacturer Qualifications
1. Installer shall have an established working relationship with Control System Manufacturer. Contractor shall be familiar with any new software to install.
  2. Installer shall have successfully completed Control System Manufacturer's control system training. Upon request, Installer shall present record of completed training including course outlines.

1.5 CODES AND STANDARDS

- A. Work, materials, and equipment shall comply with the most restrictive of local, state, and federal authorities' codes and ordinances or these plans and specifications. As a minimum, the installation shall comply with current editions in effect 30 days prior to receipt of bids of the following codes:
1. National Electric Code (NEC)
  2. International Building Code (IBC)
    - a. Chapter 28 Mechanical
  3. International Mechanical Code

1.6 SYSTEM PERFORMANCE

- B. Performance Standards. System shall conform to the following minimum standards over network connections. Systems shall be tested using manufacturer's recommended hardware and software.
1. Graphic Display. A graphic with 20 dynamic points shall display with current data within 10 sec.
  2. Graphic Refresh. A graphic with 20 dynamic points shall update with current data within 8 sec. and shall automatically refresh every 15 sec.



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3. Configuration and Tuning Screens. Screens used for configuring, calibrating, or tuning points, PID loops, and similar control logic shall automatically refresh within 6 sec.
4. Object Command. Devices shall react to command of a binary object within 2 sec. Devices shall begin reacting to command of an analog object within 2 sec.
5. Alarm Response Time. An object that goes into alarm shall be annunciated at the workstation within 15 sec.
6. Program Execution Frequency. Custom and standard applications shall be capable of running as often as once every 5 sec. Select execution times consistent with the mechanical process under control.
7. Performance. Programmable controllers shall be able to completely execute DDC PID control loops at a frequency adjustable down to once per sec. Select execution times consistent with the mechanical process under control.
8. Multiple Alarm Annunciation. Each workstation on the network shall receive alarms within 5 sec of other workstations.

## 1.7 SUBMITTALS

- C. Product Submittal Requirements: Provide six copies of shop drawings and other submittals on hardware, software, and equipment to be installed or furnished. Begin no work until submittals have been approved for conformity with design intent. Provide 3 prints of each drawing on 11" x 17" paper. When manufacturer's cutsheets apply to a product series rather than a specific product, clearly indicate applicable data by highlighting or by other means. Clearly reference covered specification and drawing on each submittal. General catalogs shall not be accepted as cutsheets to fulfill submittal requirements. Select and show submittal quantities appropriate to scope of work. Submittal approval does not relieve Contractor of responsibility to supply sufficient quantities to complete work.
1. Direct Digital Control System Hardware
    - a. Complete bill of materials indicating quantity, manufacturer, model number, and relevant technical data of equipment to be used.
    - b. Manufacturer's description and technical data such as performance curves, product specifications, and installation and maintenance instructions for items listed below and for relevant items not listed below:
      - 1) Direct digital controllers (controller panels)
      - 2) Transducers and transmitters
      - 3) Sensors (include accuracy data)
      - 4) Relays and switches
      - 5) Control panels
      - 6) Power supplies
      - 7) Batteries
      - 8) Operator interface equipment
      - 9) Wiring
    - c. Wiring diagrams and layouts for each control panel. Show termination numbers.
    - d. Floor plan schematic diagrams indicating field sensor and controller locations.
      - 1) Color graphic software
      - 2) Third-party software
    - e. Schematic diagrams of control, communication, and power wiring for central system installation. Show interface wiring to control system.
    - f. Network riser diagrams of wiring between central control unit and control panels.

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- g. Points List
    - 2. Controlled Systems
      - a. Riser diagrams showing control network layout, communication protocol, and wire types.
      - b. Schematic diagram of each controlled system. Label control points with point names. Graphically show locations of control elements.
      - c. Schematic wiring diagram of each controlled system. Label control elements and terminals. Where a control element is also shown on control system schematic, use the same name.
      - d. Instrumentation list (Bill of Materials) for each controlled system. List each control system element in a table. Show element name, type of device, manufacturer, model number, and product data sheet number.
      - e. Complete description of control system operation including sequences of operation. Include and reference schematic diagram of controlled system. List I/O points and software points specified. Indicate alarmed and trended points.
    - 3. Description of process, report formats, and checklists to be used in Section 15900 Article 3.12 (Control System Demonstration and Acceptance).
  - D. Schedules
    - 1. Schedule of work provided within one month of contract award, indicating:
      - a. Intended sequence of work items
      - b. Start date of each work item
      - c. Duration of each work item
      - d. Planned delivery dates for ordered material and equipment and expected lead times
      - e. Milestones indicating possible restraints on work by other trades or situations
    - 2. Weekly written status reports indicating work completed and revisions to expected delivery dates. Include updated schedule of work.
  - E. Project Record Documents. Submit three copies of record (as-built) documents upon completion of installation for approval prior to final completion. Submittal shall consist of:
    - 1. Project Record Drawings. As-built versions of submittal shop drawings and 6 prints of each drawing on 11" x 17" paper.
    - 2. Testing and Commissioning Reports and Checklists. Completed versions of reports, checklists, and trend logs used to meet requirements of Section 15900 Article 3.16 (Control System Demonstration and Acceptance).
    - 3. Operation and Maintenance (O&M) Manual. Printed, electronic, or online help documentation of the following:
      - a. As-built versions of submittal product data.
      - b. Names, addresses, and telephone numbers of installing contractors and service representatives for equipment and control systems.
      - c. Operator's manual with procedures for operating control systems: logging on and off, handling alarms, producing point reports, trending data, and changing setpoints and variables.
      - d. Electronic copies of programs shall meet this requirement if control logic, setpoints, tuning parameters, and objects can be viewed using furnished programming tools.
      - e. List of recommended spare parts with part numbers and suppliers.
      - f. Complete original-issue documentation, installation, and maintenance information for furnished third-party hardware including computer equipment and sensors.
      - g. Licenses, guarantees, and warranty documents for equipment and systems.



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- h. Recommended preventive maintenance procedures for system components, including schedule of tasks such as inspection, cleaning, and calibration; time between tasks; and task descriptions.

### F. Leak Detection system:

- 1. Submit Manufacturer's data, including leak detection panel and leak detection system cable layout drawing showing cable routing and leak detection panels.
- 2. Submit Operation and Maintenance manuals

### 1.7 WARRANTY

#### A. Warrant work as follows:

- 1. Warrant labor and materials for specified control system free from defects for a period of 12 months after final acceptance. Control system failures during warranty period shall be adjusted, repaired, or replaced at no additional cost or reduction in service to Government. Respond during normal business hours within 24 hours of Government's warranty service request.
- 2. Work shall have a single warranty date, even if Government receives beneficial use due to early system start-up. If specified work is split into multiple contracts or a multi-phase contract, each contract or phase shall have a separate warranty start date and period.
- 3. If COR determines that equipment and systems operate satisfactorily at the end of final start-up, testing, and commissioning phase, COR will certify in writing that control system operation has been tested and accepted in accordance with the terms of this specification. Date of acceptance shall begin warranty period.
- 4. Exception: Contractor shall not be required to warrant reused devices except those that have been rebuilt or repaired. Installation labor and materials shall be warranted. Demonstrate operable condition of reused devices at time of COR's acceptance.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Use new products the manufacturer is currently manufacturing and selling for use in new installations. Do not use this installation as a product test site unless explicitly approved in writing by Government. Spare parts shall be available for at least five years after completion of this contract.

### 2.2 LEAK DETECTION PANEL

- A. Provide leak detection system capable of detecting presence of water(40 to 174 degrees F) along length of new leak detection cable. Upon detection of water, the system shall sound an alarm and pinpoint the location of the leak on a display on the leak detection system panel. A DDC(direct digital control) alarm input shall also activate an alarm at existing facility front end computer.



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- B. Provide all required items for leak detection system, including, but not limited to, leak detection panel, leak sensing cable, jumper cable, alarms and locator module, module signal processor, and system map
- C. Alarms and locator module: Alarm and locator module shall be able to detect presence of water along the cable and indicate the location of first contact with water with a precision of at least one percent of the cable length regardless of the position of the water ingress along the cable. The location of the first water contact shall be retained on the display of the alarm and locator module until the module is updated. The signal processor module shall be powered by 110VAC. The module shall have labeled colored pilot lights indicating POWER, SERVICE, LEAK, and FAULT. Each light shall have a different color. The module shall include test, audible, and visual alarm acknowledge or (alarm silence) and update functions as a minimum. Only the acknowledge or alarm silence function shall be accessible from the exterior of the enclosure. Other functions shall require access by key.
- D. Module signal processor: The alarm and locator module shall sound a local alarm, actuate an output relay, and have a 4 line by 20 character backlit LCD read out that displays the distance in feet from the start of the sensing cable to the location of the first water ingress along the cable. The alarm and locator module shall have three sets of DPDT contacts rated for 110VAC for the alarm contact to be used to send a signal to the existing facility front end DDC computer. Sensitivity of the module shall be adjustable, enabling the system to detect leaks of different sizes. The module shall have a precision of 0.1 percent maximum of the cable length independent of the position of the water ingress along the cable. Provide a steel cabinet conforming to NEMA OS-1, Type 1, with continuously hinged doors and engraved nameplates
- E. Leak sensing cable: As a minimum, the leak sensing cable shall consist of two sensor wires, a continuity monitor wire, and an insulated signal return wire. The sensor wires shall be jacketed by a conductive polymer to protect the conductors from corrosion. The sensor wires, continuity wire, and signal wire shall be covered by an abrasion resistant protective braid. The cable shall be provided in modular lengths of 3, 10, 25, or 50 feet with factory installed male/female quick connect type connectors on each end. The cable shall be flexible and carry not more than 24V DC under normal operating conditions.
- F. Jumper cable: The jumper cable shall consist of four wires in an overall insulated jacket to provide continuity between the four wires in the segments of the water sensing cable. The cable shall be provided in modular lengths of 3, 10, 25, or 50 feet with factory installed male/female quick-connect type connectors on each end that are compatible with the connectors on the water sensing cable.
- G. System map: Provide a new locator map to show layout of the leak detection cable. The map shall show the exact layout of the new cable system with numerical indications in feet of each 25 ft interval along the cable and at the center of each bend. The map shall show all locations of leak detection panels. The map shall be drawn at not less than 1/8 inch per foot scale and shall be clearly legible. Map shall be installed behind a clear Plexiglas sheet for protection.

### 2.3 INPUT AND OUTPUT INTERFACE

- A. General. Hard-wire input and output points to BCs, AACs, ASCs, or SAs.
- B. Binary Inputs. Binary inputs shall monitor the on and off signal from a remote device. Binary inputs shall provide a wetting current of at least 12 mA and shall be protected against contact bounce and noise. Binary inputs shall sense dry contact closure without application of power external to the controller.
- C. Pulse Accumulation Inputs. Pulse accumulation inputs shall conform to binary input requirements and shall accumulate up to 10 pulses per second.
- D. Analog Inputs. Analog inputs shall monitor low-voltage (0-10 Vdc), current (4-20 mA), or resistance (thermistor or RTD) signals. Analog inputs shall be compatible with and field configurable to commonly available sensing devices.
- E. Binary Outputs. Binary outputs shall send an on-or-off signal for on and off control. Building Controller binary outputs shall have three-position (on-off-auto) override switches and status lights. Outputs shall be selectable for normally open or normally closed operation.
- F. Analog Outputs. Analog outputs shall send a modulating 0-10 Vdc or 4-20 mA signal as required to properly control output devices. Each Building Controller analog output shall have a two-position (auto-manual) switch, a manually adjustable potentiometer, and status lights. Analog outputs shall not drift more than 0.4% of range annually.
- G. Tri-State Outputs. Control three-point floating electronic actuators without feedback with tri-state outputs (two coordinated binary outputs). Tri-State outputs may be used to provide analog output control in zone control and terminal unit control applications such as VAV terminal units, duct-mounted heating coils, and zone dampers.
- H. Universal Inputs and Outputs. Inputs and outputs that can be designated as either binary or analog in software shall conform to the provisions of this section that are appropriate for their designated use.

### 2.4 POWER SUPPLIES

- A. Power Supplies. Control transformers shall be UL listed. Furnish Class 2 current-limiting type or furnish over-current protection in primary and secondary circuits for Class 2 service in accordance with NEC requirements. Limit connected loads to 80% of rated capacity.
  - 1. DC power supply output shall match output current and voltage requirements. Unit shall be full-wave rectifier type with output ripple of 5.0 mV maximum peak-to-peak. Regulation shall be 1.0% line and load combined, with 100-microsecond response time for 50% load changes. Unit shall have built-in over-voltage and over-current protection and shall be able to withstand 150% current overload for at least three seconds without trip-out or failure.
    - a. Unit shall operate between 0°C and 50°C (32°F and 120°F). EM/RF shall meet FCC Class B and VDE 0871 for Class B and MILSTD 810C for shock and vibration.
    - b. Line voltage units shall be UL recognized and CSA listed.



## 2.5 AUXILARY CONTROL DEVICES

- A. Electric Damper and Valve Actuators.
  - 1. Stall Protection. Mechanical or electronic stall protection shall prevent actuator damage throughout the actuator's rotation.
  - 2. Spring-return Mechanism. Actuators used for power-failure and safety applications shall have an internal mechanical spring-return mechanism or an uninterruptible power supply (UPS).
  - 3. Signal and Range. Proportional actuators shall accept a 0-10 Vdc or a 0-20 mA control signal and shall have a 2-10 Vdc or 4-20 mA operating range. (Floating motor actuators may be substituted for proportional actuators in terminal unit applications as described in paragraph 2.6H.)
  - 4. Wiring. 24 Vac and 24 Vdc actuators shall operate on Class 2 wiring.
  - 5. Manual Positioning. Operators shall be able to manually position each actuator when the actuator is not powered. Non-spring-return actuators shall have an external manual gear release. Spring-return actuators with more than 7 N·m (60 in.-lb) torque capacity shall have a manual crank.
  - 6. Provide actuators of other voltages where needed.
  - 7. Differential pressure switches shall have scale range and differential suitable for intended application and NEMA 1 enclosure unless otherwise specified.
- B. Relays.
  - 1. Control Relays. Control relays shall be plug-in type, UL listed, and shall have dust cover and LED "energized" indicator. Contact rating, configuration, and coil voltage shall be suitable for application.
  - 2. Time Delay Relays. Time delay relays shall be solid-state plug-in type, UL listed, and shall have adjustable time delay. Delay shall be adjustable  $\pm 100\%$  from setpoint shown. Contact rating, configuration, and coil voltage shall be suitable for application. Provide NEMA 1 enclosure for relays not installed in local control panel.
- C. Override Timers.
  - 1. Unless implemented in control software, override timers shall be spring-wound line voltage, UL Listed, with contact rating and configuration required by application. Provide 0-6 hour calibrated dial unless otherwise specified. Flush mount timer on local control panel face or where shown.
- D. Current Transmitters.
  - 1. AC current transmitters shall be self-powered, combination split-core current transformer type with built-in rectifier and high-gain servo amplifier with 4-20 mA two-wire output. Full-scale unit ranges shall be 10 A, 20 A, 50 A, 100 A, 150 A, and 200 A, with internal zero and span adjustment. Unit accuracy shall be  $\pm 1\%$  full-scale at 500 ohm maximum burden.
  - 2. Transmitter shall meet or exceed ANSI/ISA S50.1 requirements and shall be UL/CSA recognized.
  - 3. Unit shall be split-core type for clamp-on installation on existing wiring.
- E. Current Transformers.
  - 1. AC current transformers shall be UL/CSA recognized and shall be completely encased (except for terminals) in approved plastic material.
  - 2. Transformers shall be available in various current ratios and shall be selected for  $\pm 1\%$  accuracy at 5 A full-scale output.
  - 3. Use fixed-core transformers for new wiring installation and split-core transformers for existing wiring installation.



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- F. Voltage Transmitters.
  - 1. AC voltage transmitters shall be self-powered single-loop (two-wire) type, 4-20 mA output with zero and span adjustment.
  - 2. Adjustable full-scale unit ranges shall be 100-130 Vac, 200-250 Vac, 250-330 Vac, and 400-600 Vac. Unit accuracy shall be  $\pm 1\%$  full-scale at 500 ohm maximum burden.
  - 3. Transmitters shall meet or exceed ANSI/ISA S50.1 requirements and shall be UL/CSA recognized at 600 Vac rating.
- G. Voltage Transformers.
  - 1. AC voltage transformers shall be UL/CSA recognized, 600 Vac rated, and shall have built-in fuse protection.
  - 2. Transformers shall be suitable for ambient temperatures of 4°C-55°C (40°F-130°F) and shall provide  $\pm 0.5\%$  accuracy at 24 Vac and 5 VA load.
  - 3. Windings (except for terminals) shall be completely enclosed with metal or plastic.
- H. Power Monitors.
  - 1. Power monitors shall be three-phase type and shall have three-phase disconnect and shorting switch assembly, UL listed voltage transformers, and UL listed split-core current transformers.
  - 2. Power monitors shall provide selectable output: rate pulse for kWh reading or 4-20 mA for kW reading. Power monitors shall operate with 5 A current inputs and maximum error of  $\pm 2\%$  at 1.0 power factor or  $\pm 2.5\%$  at 0.5 power factor.
- I. Current Switches.
  - 1. Current-operated switches shall be self-powered, solid-state with adjustable trip current. Select switches to match application current and DDC system output requirements.
- J. Local Control Panels.
  - 1. Indoor control panels shall be fully enclosed NEMA 1 construction with hinged door key-lock latch and removable sub-panels. A common key shall open each control panel and sub-panel.
  - 2. Prewire internal and face-mounted device connections with color-coded stranded conductors tie-wrapped or neatly installed in plastic troughs. Field connection terminals shall be UL listed for 600 V service, individually identified per control and interlock drawings, with adequate clearance for field wiring.
  - 3. Each local panel shall have a control power source power switch (on-off) with overcurrent protection.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Thoroughly examine project plans for control device and equipment locations. Report discrepancies, conflicts, or omissions to COR for resolution before starting rough-in work.
- B. Inspect site to verify that equipment can be installed as shown. Report discrepancies, conflicts, or omissions to COR for resolution before starting rough-in work.
- C. Examine drawings and specifications for work of others. Report inadequate headroom or space conditions or other discrepancies to COR and obtain written instructions for changes necessary to accommodate Section 15900 work with work of others. Controls Contractor shall perform at

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his expense necessary changes in specified work caused by failure or neglect to report discrepancies.

### 3.2 PROTECTION

- A. Controls Contractor shall protect against and be liable for damage to work and to material caused by Contractor's work or employees.
- B. Controls Contractor shall be responsible for work and equipment until inspected, tested, and accepted. Protect material not immediately installed. Close open ends of work with temporary covers or plugs during storage and construction to prevent entry of foreign objects.

### 3.3 COORDINATION

- A. Site.
  - 1. Assist in coordinating space conditions to accommodate the work of each trade where work will be installed near or will interfere with work of other trades. If installation without coordination causes interference with work of other trades, Contractor shall correct conditions without extra charge.
  - 2. Coordinate and schedule work with other work in the same area and with work dependent upon other work to facilitate mutual progress.
- B. Submittals. See Section 15900 Article 1.7 (Submittals).

### 3.4 GENERAL WORKMANSHIP

- A. Furnish and install new EMT(Electrical Metallic Tubing) conduit for all new DDC control and communication wiring. Install equipment, piping, and wiring or raceway horizontally, vertically, and parallel to walls wherever possible.
- B. Provide sufficient slack and flexible connections to allow for piping and equipment vibration isolation.
- C. Install equipment in readily accessible locations as defined by National Electrical Code (NEC) Chapter 1 Article 100 Part A.
- D. Verify wiring integrity to ensure continuity and freedom from shorts and ground faults.
- E. Equipment, installation, and wiring shall comply with industry specifications and standards and local codes for performance, reliability, and compatibility.

### 3.5 FIELD QUALITY CONTROL

- A. Work, materials, and equipment shall comply with rules and regulations of applicable local, state, and federal codes and ordinances as identified in Section 15900 Article 1.5 (Codes and Standards).
- B. Continually monitor field installation for code compliance and workmanship quality.
- C. Contractor shall arrange for work inspection by local or state authorities having jurisdiction over the work.

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### 3.6 WIRING

- A. Control and interlock wiring and installation shall comply with national and local electrical codes, and manufacturer's recommendations. NEC Class 1 (line voltage) wiring shall be UL listed in approved raceway as specified by NEC.
- B. Low-voltage wiring shall meet NEC Class 2 requirements. Subfuse low-voltage power circuits as required to meet Class 2 current limit.
- C. NEC Class 2 (current-limited) wires not in raceway but in concealed and accessible locations such as return air plenums shall be UL listed for the intended application. Use plenum rated signal and communication wiring.
- D. Do not install wiring in raceway containing tubing.
- E. Run exposed Class 2 wiring parallel to a surface or perpendicular to it and tie neatly at 3 m (10 ft) intervals.
- F. Use structural members to support or anchor plenum cables without raceway. Do not use ductwork, electrical raceways, piping, or ceiling suspension systems to support or anchor cables.
- G. Secure raceways with raceway clamps fastened to structure and spaced according to code requirements. Raceways and pull boxes shall not be hung on or attached to ductwork, electrical raceways, piping, or ceiling suspension systems.
- H. Size raceway and select wire size and type in accordance with manufacturer's recommendations and NEC requirements.
- I. Include one pull string in each raceway 2.5 cm (1 in.) or larger.
- J. Use color-coded conductors throughout.
- K. Locate control and status relays in designated enclosures only. Do not install control and status relays in packaged equipment control panel enclosures containing Class 1 starters.
- L. Conceal raceways except within mechanical, electrical, or service rooms. Maintain minimum clearance of 15 cm (6 in.) between raceway and high-temperature equipment such as steam pipes or flues.
- M. Install insulated bushings on raceway ends and enclosure openings. Seal top ends of vertical raceways.
- N. Terminate control and interlock wiring related to the work of this section. Maintain at the job site updated (as-built) wiring diagrams that identify terminations.
- O. Flexible metal raceways and liquid-tight flexible metal raceways shall not exceed 1 m (3 ft) in length and shall be supported at each end. Do not use flexible metal raceway less than 3/4 in. electrical trade size. Use liquid-tight flexible metal raceways in areas exposed to moisture including chiller and boiler rooms.
- P. Install raceway rigidly, support adequately, ream at both ends, and leave clean and free of obstructions. Join raceway sections with couplings and according to code. Make terminations in boxes with fittings. Make terminations not in boxes with bushings.



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## 3.7 COMMUNICATION WIRING

- A. Communication wiring shall be low-voltage Class 2 wiring and shall comply with Article 3.7 (Wiring). DDC signal and communication wiring shall be plenum rated.
- B. During installation do not exceed maximum cable pulling, tension, or bend radius specified by the cable manufacturer.
- C. Verify entire network's integrity following cable installation using appropriate tests for each cable.
- D. Install lightning arrestor according to manufacturer's recommendations between cable and ground where a cable enters or exits a building.
- E. Each run of communication wiring shall be a continuous length without splices when that length is commercially available. Runs longer than commercially available lengths shall have as few splices as possible using commercially available lengths.
- F. Label communication wiring to indicate origination and destination.
- G. Ground coaxial cable according to NEC regulations article on "Communications Circuits, Cable, and Protector Grounding."

## 3.8 INSTALLATION OF SENSORS

- A. Install sensors according to manufacturer's recommendations.
- B. Mount sensors rigidly and adequately for operating environment.
- C. Air seal wires attached to sensors in their raceways or in the wall to prevent sensor readings from being affected by air transmitted from other areas.

## 3.9 WARNING LABELS

- A. Affix permanent warning labels to equipment that can be automatically started by the control system.
  - 1. Labels shall use white lettering (12-point type or larger) on a red background.
  - 2. Warning labels shall read as follows:  
**C A U T I O N**  
**This equipment is operating under automatic control and may start or stop at any time without warning. Switch disconnect to "Off" position before servicing.**
- B. Affix permanent warning labels to motor starters and control panels that are connected to multiple power sources utilizing separate disconnects.
  - 1. Labels shall use white lettering (12-point type or larger) on a red background.
  - 2. Warning labels shall read as follows.  
**C A U T I O N**

**This equipment is fed from more than one power source with separate disconnects. Disconnect all power sources before servicing.**

### 3.10 IDENTIFICATION OF HARDWARE AND WIRING

- A. Label wiring and cabling, including that within factory-fabricated panels, with control system address or termination number at each end within 5 cm (2 in.) of termination.
- B. Permanently label or code each point of field terminal strips to show instrument or item served.
- C. Label control panels with minimum 1 cm (½ in.) letters on laminated plastic nameplates.
- D. Label each control component with a permanent label. Label plug-in components such that label remains stationary during component replacement.
- E. Label room sensors related to terminal boxes or valves with nameplates.
- F. Manufacturers' nameplates and UL or CSA labels shall be visible and legible after equipment is installed.
- G. Label identifiers shall match record documents.

### 3.11 PROGRAMMING

- A. Point Naming. Name points as shown on the equipment points list provided with each sequence of operation. If character limitations or space restrictions make it advisable to shorten the name, the abbreviations given in Appendix C may be used.
- B. Software Programming. Programming shall provide actions for each possible situation. Graphic- or parameter-based programs shall be documented. Text-based programs shall be modular, structured, and commented to clearly describe each section of the program.
  - 1. Application Programming. Provide application programming that adheres to sequences of operation specified. Program documentation or comment statements shall reflect language used in sequences of operation.
  - 2. System Programming. Provide system programming necessary for system operation.

### 3.12 CONTROL SYSTEM CHECKOUT AND TESTING

- A. Startup Testing. Complete startup testing to verify operational control system before notifying Government of system demonstration. Provide Government with schedule for startup testing. Government may have representative present during any or all startup testing.
  - 1. Calibrate and prepare for service each instrument, control, and accessory equipment furnished under Section 15900.
  - 2. Verify that control wiring is properly connected and free of shorts and ground faults. Verify that terminations are tight.
  - 3. Enable control systems and verify each input device's calibration. Calibrate each device according to manufacturer's recommendations.
  - 4. Verify that binary output devices such as relays, solenoid valves, two-position actuators and control valves, and magnetic starters, operate properly and that normal positions are correct.
  - 5. Verify that analog output devices such as I/Ps and actuators are functional, that start and span are correct, and that direction and normal positions are correct. Prepare a log



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documenting startup testing of each input and output device, with technician's initials certifying each device has been tested and calibrated.

6. Verify that system operates according to sequences of operation. Simulate and observe each operational mode by overriding and varying inputs and schedules. Tune PID loops and each control routine that requires tuning.
7. Alarms and Interlocks.
  - a. Check each alarm with an appropriate signal at a value that will trip the alarm.
  - b. Trip interlocks using field contacts to check logic and to ensure that actuators fail in the proper direction.
  - c. Test interlock actions by simulating alarm conditions to check initiating value of variable and interlock action.

### 3.13 CONTROL SYSTEM DEMONSTRATION AND ACCEPTANCE

- A. Demonstration. Prior to acceptance, perform the following performance tests to demonstrate system operation and compliance with specification after and in addition to tests specified in Article 3.15 (Control System Checkout and Testing). Provide COR with log documenting completion of startup tests.
  1. COR will be present to observe and review system demonstration. Notify COR at least 10 days before system demonstration begins.
  2. Demonstration shall follow process submitted and approved under Section 15900 Article 1.6 (Submittals). Complete approved checklists and forms for each system as part of system demonstration.
  3. Demonstrate actual field operation of each sequence of operation. Provide at least two persons equipped with two-way communication. Demonstrate calibration and response of any input and output points requested by COR. Provide and operate test equipment required to prove proper system operation.
  4. Demonstrate compliance with Section 15900 Article 1.6 (System Performance).
  5. Demonstrate compliance with sequences of operation through each operational mode.
  6. Demonstrate complete operation of operator interface.
  7. Demonstrate each of the following.
    - a. DDC loop response. Supply graphical trend data output showing each DDC loop's response to a setpoint change representing an actuator position change of at least 25% of full range. Trend sampling rate shall be from 10 seconds to 3 minutes, depending on loop speed. Each sample's trend data shall show setpoint, actuator position, and controlled variable values. COR will require further tuning of each loop that displays unreasonably under- or over-damped control.
  8. Tests that fail to demonstrate proper system operation shall be repeated after Contractor makes necessary repairs or revisions to hardware or software to successfully complete each test.
- B. Acceptance.
  1. After tests described in this specification are performed to the satisfaction of both COR and Government, COR will accept control system as meeting completion requirements. COR may exempt tests from completion requirements that cannot be performed due to circumstances beyond Contractor's control. COR will provide written statement of each exempted test. Exempted tests shall be performed as part of warranty.
  2. System shall not be accepted until completed demonstration forms and checklists are submitted and approved as required in Section 15900 Article 1.7 (Submittals).
  3. Provide a written test report to Resident Engineer.



INSTALL LEAK DETECTION IN AUTOMATION AND COMMUNICATIONS EQUIPMENT  
ROOMS

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3.14 CLEANING

- A. Each day clean up debris resulting from work. Remove packaging material as soon as its contents have been removed. Collect waste and place in designated location.
- B. On completion of work in each area, clean work debris and equipment. Keep areas free from dust, dirt, and debris.
- C. On completion of work, check equipment furnished under this section for paint damage. Repair damaged factory-finished paint to match adjacent areas. Replace deformed cabinets and enclosures with new material and repaint to match adjacent area.

END OF SECTION 15900

## Install Leak Detection in Automation and Communications Equipment Rooms

### Scope of Work

1. Automation Equipment Room: Remove existing PVC insulation cover on chilled water piping serving air handling units CRU-4, CRU-5, AHU 4A, AHU-4B, and AHU-5 from under-floor plenum and above. Install new leak detection cable on this piping and cover with new PVC pipe insulation cover. Install leak detection cable around perimeter of both air handling units CRU-4 and CRU-5 on concrete plenum floor. Install new leak detection panel for these units in Room B101. Connect new leak detection cable to new leak detection panel.
2. Communications Equipment Room: Remove existing leak detection panel and leak detection cabling for air handling units CU-1, CU-2, and CU-3 on concrete plenum floor in Room B110. Install new leak detection cable on chilled water piping and domestic water piping in the raised floor plenum serving these three air handling units. Cover new leak detection cable on chilled water piping with PVC pipe insulation cover. Install new leak detection cable on concrete plenum floor around perimeter of each air handling unit CU-1, CU-2, and CU-3. Install new leak detection panel for these units in Room B110. Connect new leak detection cable to new leak detection panel.
3. Connect new leak detection panels to existing facility Direct Digital Control (DDC) System. Each leak detection panel shall send an alarm to the existing front end computer when a leak is sensed by the new leak detection systems. Provide all DDC front end programming and graphics, control and communications conduit and wiring, electrical power supplies, and any other required DDC accessories.